

The relationship between nutritional status and the eruption of lower permanent incisors in 6-7-year-old students at Candijati 01 elementary school in Arjasa, Jember, Indonesia

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Abstract

Tooth eruption is a normal movement of tooth to the oral cavity from its growth position in alveolar bone. This process is influenced by various factors, one of which is nutritional status. The aim of this study was to determine the relationship between nutritional status and the eruption of permanent mandibular incisors. This descriptive analytic study with a cross-sectional design involved 43 students aged 6-7 years from Candijati 01 Elementary School, Arjasa, Jember. The nutritional status was assessed using the Body Mass Index (BMI) according to age. The subjects were categorized into three nutritional status groups: underweight, normal, and overweight. Results are analyzed using the Spearman statistical test, indicated a significant relationship between nutritional status and the eruption of permanent mandibular incisors ($p < 0.05$). The conclusion of this study is that there is a significant relationship between nutritional status and the eruption status of permanent mandibular incisors in children aged 6-7 years.

Keywords: Nutritional Status; Tooth Eruption; Permanent Mandibular Incisors; Children; BMI.

1. Introduction

The growth and development of permanent teeth in children is a crucial aspect that requires attention. Eruption disturbances are commonly found during the growth and development stages of children's teeth. Tooth eruption is the process of tooth germ movement from within the alveolar process to its functional position in the oral cavity. [1] Tooth eruption is a complex process divided into three stages: the pre-eruption stage, the eruption stage, and the post-eruption stage. [2] Monitoring occlusal development, diagnosing malocclusion, and efficiently planning dental care in childhood and adolescence are crucial functions of tooth eruption. [3] The eruption of teeth in the mouth follows different timelines for each type of tooth, starting with the primary teeth phase, followed by the permanent teeth phase, causing variations in the time and order of emergence of these teeth. [3] The timing of tooth eruption varies widely due to several factors including genetics, race, premature birth, gender differences, socioeconomic status, craniofacial morphology, hormonal factors, various systemic diseases, nutrition, and nutritional status. These factors can either accelerate or delay tooth. [2]

Nutritional status is the state of the body as a result of the balance between nutrient intake and the use of nutrients for various biological functions. [4] Nutritional status can affect skeletal growth and bone maturity. Nutrients needed for the development of teeth in the oral cavity are the same as for other body tissues and organs. Nutritional deficiencies can affect tooth development because the role of nutrition for oral tissues is the same as for other body tissues. Lack of calcium, phosphorus, vitamin C, and vitamin D intake can inhibit bone growth, including tooth development and delayed tooth eruption. [5] Adequate nutritional intake will positively impact the functioning of body organs in processing nutrients, which will be reflected in a person's growth and development. [6] Nutritional intake is crucial for the process of tooth growth and development.

Nutritional status can be measured using anthropometry based on BMI-for-age by collecting data on children's age, weight, and height. [4] According to the Indonesian Minister of Health Regulation No. 2 of 2020 [7], the nutritional status of children can be assessed using the Body Mass Index for Age (BMI-for-age) for children aged 5-18 years. BMI-for-age measurements are classified into five categories: severely thin, thin, normal, overweight, and obese. Children with poor nutritional status tend to experience delayed eruption of permanent teeth, children with good nutritional status experience timely eruption of permanent teeth, while children with overweight/obesity tend to experience earlier eruption of permanent teeth. [8]

The lower central incisors usually erupt at the age of 6-7 years and the roots close at the age of 9 years, while the lower lateral incisors erupt at the age of 7-8 years and the roots close at the age of 10 years. [2] Children within this age range are generally in grades I-III of elementary school. Delayed eruption of the central incisors can cause the lateral incisors to shift medially, occupying the space meant for

the central incisors, potentially leading to malocclusion. Non-eruption of the incisors can also negatively impact facial aesthetics, potentially leading to reduced self-confidence and social interaction issues in children. [9]

Candijati 01 is an elementary school located in the agro-industrial environment of Jember Regency. This school is the closest to the Bobbin Industrial Unit area, Candijati, Arjasa. Arjasa District is one of the northern districts of Jember, consisting of 6 villages. [10] Preliminary observations by the researchers revealed that many vendors sell various snacks in the

Candijati 01 Elementary School area, making it easy for students to buy snacks. Students rarely bring food from home and many buy snacks during breaks. This habit affects children's appetite, which can impact the nutrient intake required for growth and development. Nutritional adequacy in the body is influenced by consumption methods, types, and meal times, all of which will affect dental and oral health, including disturbances in tooth growth and development. [3], [11]

Based on this background, the researchers are interested in examining the relationship between nutritional status and the eruption of permanent mandibular incisors in 6-7 year old students at Candijati 01 Elementary School, Arjasa District, Jember Regency. This study is expected to provide an understanding of the nutritional status of 6-7 year old students at Candijati 01 Elementary School and its influence on the eruption of permanent mandibular incisors.

2. Materials and methods

This study is an observational analytic study with a cross-sectional approach. The research was conducted by examining and collecting data simultaneously. The study was conducted at Candijati 01 Elementary School, Arjasa District, Jember Regency from December 2023 to February 2024. The study population consisted of 43 students aged 6-7 years at Candijati 01 Elementary School, Arjasa District, Jember Regency. The sample size was 43 students aged 6-7 years at Candijati 01 Elementary School, Arjasa District, Jember Regency. The sampling technique used was total sampling, utilizing all respondents as the research sample. Inclusion criteria included individuals aged 6-7 years and enrolled at Candijati 01 who were willing to participate in the study with parental consent. Exclusion criteria included individuals aged 6-7 years who did not have parental consent and those not present during the study.

The independent variable in this study was the nutritional status of 6-7 year old students at Candijati 01 Elementary School, Arjasa District, Jember Regency, while the dependent variable was the eruption of permanent mandibular incisors in 6-7 year old students at Candijati 01 elementary School, Arjasa District, Jember Regency.

Nutritional status is a measure used to determine a person's health condition based on nutrient intake and utilization. Nutritional status was assessed using the Body Mass Index for Age (BMI-for-age) method, calculated using Z-scores. Nutritional status was classified into three categories: undernutrition, normal nutrition, and overnutrition. Tooth eruption is defined as the gradual movement of a tooth from its formation site in the alveolar bone to the occlusal plane until it reaches its functional position in the oral cavity. Lower permanent incisors were considered erupted if the crown of the tooth had emerged through the gums and was clearly visible in the oral cavity, with at least part of the tooth crown above the gum line. The eruption of the four lower incisors was categorized into five groups. Six- to seven-year-old students are children aged between six and seven years who are usually in the first or second grade of elementary school. These students were identified based on official school records indicating their birth dates.

The tools used in this study included informed consent forms, writing instruments, level 1 personal protective equipment (PPE), a Canon 1200D digital camera, cheek retractors, a height measuring instrument/stadiometer (Onemed brand), and a body weight scale (Onemed brand). Materials used included water, antiseptic solution, tissues, and hand soap. The preparation phase included conducting preliminary surveys, determining the location and timing of the study, submitting ethical clearance to the Health Ethics Committee of the Faculty of Dentistry, University of Jember, and preparing research permission letters to the Jember Regency National Unity and Political Agency (Bakesbangpol), Jember Regency Education Office, Jember Regency Health Office, Candijati 01 Elementary School, and Arjasa Community Health Center. The implementation phase included researchers visiting Candijati 01 Elementary School and preparing sterile research tools and materials, having 6-7 year old children return the informed consent forms to the researchers, instructing 6-7 year old children to wash their hands with soap and rinse their mouths, installing cheek retractors on the students and taking photos of their lower permanent incisors to determine tooth eruption, measuring height and weight to determine the nutritional status of the subjects, and recording examination results on examination forms.

The relationship between nutritional status and the eruption of lower permanent incisors was analyzed univariately and bivariately. Univariate analysis was conducted to analyze the descriptive characteristics of the research subjects using frequency distribution and percentage values. Bivariate analysis was conducted to analyze the relationship between two variables, namely nutritional status and incisor eruption. The statistical test used was the Charles Spearman test because both variables had categorical and ordinal data. This study used a significance level of 5%, so if the p-value was <0.05 , it indicated a significant relationship between nutritional status and incisor eruption.

3. Result

The following table shows the frequency distribution of respondents based on gender and age in 6-7 year old students at Candijati 01 Elementary School, Arjasa District, Jember Regency.

Table 1: Distribution of Students by Gender and Age at Candijati 01 Elementary School

Variable	Gender			
	male	female	n	%
Age	6	3	5	37,5
	7	19	16	54,3

Quantitative data on the total number of students by gender obtained from Table 1 shows that the number of female students is greater than the number of male students. The number of male students is 21 and female students is 22. The research subjects were 43 children aged 6-7 years, with 8 children aged 6 years and 35 children aged 7 years. The nutritional status of 6-7 year old students at Candijati 01 Elementary School, Arjasa District, Jember Regency was assessed based on BMI-for-age according to the Indonesian Minister of Health Regulation No. 2 of 2020 on child anthropometric standards. The nutritional status of students aged 6-7 years was categorized into five categories: undernutrition, normal nutrition, overnutrition, and obesity.

Table 2: Distribution of Students by Nutritional Status at Candijati 01 Elementary School

Variable	categori	Amount	
		N	%
Nutrition Status	Underweight	5	11,6
	Normal Weight	31	72,1
	Overweight	7	16,3
	Total	43	100

Based on Table 2, most students aged 6-7 years at Candijati 01 Elementary School have normal nutritional status, with 31 students (72.1%). The number of students with undernutrition is 5 (11.6%), while 7 students (16.3%) have overnutrition. The dominant proportion of students with normal nutrition indicates that the majority of students are in adequate nutritional condition. However, there are still percentages of students with undernutrition and overnutrition that need special attention. The study on the eruption of lower permanent incisors in 6-7 year old students at Candijati 01 Elementary School was conducted by observing photos. The eruption of lower permanent incisors was categorized into five categories: no erupted teeth, 1 erupted tooth, 2 erupted teeth, 3 erupted teeth, and 4 erupted teeth. The following table shows the distribution of the total eruption of lower permanent incisors in 6-7 year old students at Candijati 01 Elementary School, Arjasa District, Jember Regency.

Table 3: Distribution of Students by Total Eruption of Lower Permanent Incisors in 6-7 Year Old Students at Candijati 01 Elementary School

Variable	Categori	Amount	
		n	%
Total permanent incisor teeth of lower jaw eruption	0 teeth erupted	4	9,3
	1 tooth erupted	2	4,7
	2 tooth erupted	11	25,6
	3 tooth erupted	3	7,0
	4 tooth erupted	23	53,5
	Total	43	100

Table 3 shows the distribution of the total eruption of lower permanent incisors in 6-7 year old students at Candijati 01 Elementary School, Arjasa District, Jember Regency. Of the 43 students observed, the majority (53.5%) had 4 erupted lower incisors. Conversely, only 4 students (9.3%) had no erupted permanent teeth. Students with 2 erupted teeth were 25.6%, while those with 1 erupted tooth were only 4.7%. The group of students with 3 erupted teeth was the fewest, with 3 students (7%). This data indicates that most students in the 6-7 year age group have experienced the eruption of lower permanent incisors.

Table 4: Distribution of Lower Permanent Incisors Eruption Status

Variable		Permanent lower incisor teeth							
		Tooth 32		Tooth 31		Tooth 41		Tooth 42	
		n	%	n	%	n	%	n	%
Tooth eruption status	Not erupted	19	44,2	6	14,0	4	9,3	18	41,9
	Erupted	24	55,8	37	86,0	39	90,7	25	58,1
	Total	43	100	43	100	43	100	43	100

Most students experienced eruption in teeth 31 and 41. The Charles Spearman test showed a p-value of 0.016, indicating a significant relationship between nutritional status and the eruption of lower permanent incisors.

Table 5: Cross-Tabulation and Charles Spearman Test Results

Variable	Total teeth erupted											
	0 teeth erupted		1 teeth erupted		2 teeth erupted		3 teeth erupted		4 teeth erupted		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Nutritional Status												
Underweight	3	7,0	0	0	1	2,3	1	2,3	0	0	5	11,6
Normal Weight	1	2,3	1	2,3	9	20,9	2	4,7	18	41,9	31	72,1
Overweight	0	0	1	2,3	1	2,3	0	0	5	11,6	7	16,3
Total	4	9,3	2	4,7	11	25,6	3	7,0	23	53,5	43	100

Children with normal nutritional status tend to have more erupted lower permanent incisors compared to children with undernutrition or overnutrition. This indicates the importance of nutritional status in the process of lower permanent incisor eruption.

Based on the results of the Spearman correlation analysis, there is a significant positive relationship between Nutritional Status and Eruption Status, with a correlation coefficient of 0.365. A positive relationship means that when nutritional status improves, the eruption status also improves, or vice versa. The obtained significance value (p-value) is 0.016, which is less than the significance level of 0.05. Therefore, there is a relationship between nutritional status and eruption status.

4. Discussion

The nutritional status of children aged 6-7 years of Candijati 01 Elementary School students in this study was categorized into malnutrition, good nutrition and overnutrition. The results of the study showed that the average respondent had good nutritional status, which was more than 70%, but there were several students with malnutrition and overnutrition. Students with malnutrition can be caused by lack of energy and protein consumption so that this unmet intake will hinder the child's growth and development process. Intake must still be met according to the needs and activities carried out so that nutritional status remains optimal, because achieving optimal nutritional status will support growth and development, productivity, and health status. [12], [13]

The results of the study in Table 2 show that there were 7 children with overweight nutritional status. Overweight and obesity can be caused by several factors, namely an imbalance in consumption patterns with the required nutrition, consumption of energy, fat, and carbohydrates that are too high and low.[14] One study stated that one of the most influential factors in the incidence of obesity in children is a sedentary lifestyle.[15] A sedentary lifestyle is a habit of someone who does not do much physical activity, such as sitting or lying down while

watching television and playing gadgets.[16] According to research conducted by Rahma & Wirjatmadi in 2020 [17], children who do low-category physical activity have a greater risk of overweight.

The process of tooth eruption requires adequate nutrition during the growth period. [11] As is the case with the growth of incisor teeth. Adequate and balanced nutrition is very important in supporting the optimal tooth eruption process. Some of the main nutrients that play a role in tooth growth and development include calcium, phosphorus, vitamin D, and protein. Calcium and phosphorus deficiencies can interfere with the mineralization of tooth enamel, making teeth more fragile and disrupting the eruption process. [18]

The eruption of permanent mandibular incisors in this study was carried out by observing the total number of permanent mandibular incisors that had emerged into the oral cavity. Based on table 4.3, it can be seen that most students aged 6-7 years have experienced the eruption of all four mandibular incisors, namely 23 students. This is in accordance with the research of Putri, et al (2020) [19], which stated that the eruption of permanent mandibular incisors occurs on average at the age of 6 years. Eruption of permanent mandibular incisors usually occurs at the age of 6-7 years, but the time of this eruption can vary based on various factors such as genetics, nutrition, general health, and oral hygiene. Research by Lee, et al (2021)[20] shows that good oral health, including routine dental care and good oral hygiene habits, can accelerate the tooth eruption process.

The results of the study in table 4 show that tooth 31 (left mandibular central incisor) and tooth 41 (right mandibular central incisor) have a faster eruption rate compared to tooth 32 (left mandibular lateral incisor) and tooth 42 (right mandibular lateral incisor). This is due to the order of emergence of the mandibular central incisor which is earlier than the mandibular lateral incisor. [21] Most students have not experienced eruption of teeth 32 and 42 because teeth 31 and 41 begin to erupt at the age of 6-7 years, while teeth 32 and 42 begin to erupt at the age of 7-8 years. [2]

Analysis using the Charles Spearman test in Table 5 shows a p-value of 0.016, which means that there is a statistically significant relationship between nutritional status and the total eruption of permanent mandibular incisors. The results of this study indicate that children with good nutritional status tend to have a higher total tooth eruption compared to children with poor or poor nutritional status. In addition, obese children show a higher distribution of tooth eruption, namely in the eruption categories of 3 and 4 teeth. This is in line with research conducted by Prijatmoko & Zakiyah (2019) [22] which states that there is a relationship between nutritional status and the eruption status of permanent teeth.

The results of this study are in line with Pratiwi (2021) [23] who stated that the development and growth of teeth are influenced by age, nutrients, nutritional status and socioeconomic status. Children with middle to upper socioeconomic status get sufficient nutritional intake, so that their nutritional status is included in the good category, and tooth growth occurs according to the time of tooth eruption. Children with overweight or obesity showed a higher distribution of permanent incisor eruption compared to children with underweight, namely 11.6% of the obese category had four tooth eruptions, compared to 5% of the underweight category. This shows that obese children tend to have faster tooth eruption compared to children with underweight. This is also supported by the statement of Anu, et al (2020) [24] which states that there is a statistically significant relationship between body mass index (BMI) on the eruption of central incisor teeth.

The results of the study in the category of normal, overweight and obese nutritional status showed that the average permanent lower incisor teeth had erupted, but there were still several respondents with a higher nutritional status category who had not yet erupted the four permanent lower incisors. This is because in addition to age, nutritional status and socio-economic status, eruption is also influenced by genetic, racial, hormonal and tissue factors around the teeth. This is in accordance with the results of a study conducted by Sitingjak, et al (2019)[4] which stated that there was no relationship between nutritional status and the eruption of the first lower molar teeth in children which may be caused by other factors such as genetic factors which are the largest factor influencing tooth eruption, namely 78%. In addition, there is a reason for the use of uncalibrated weight scales, which allows for errors in measuring body weight. [25]

5. Conclusion

This study demonstrates a significant relationship between nutritional status and the eruption of lower permanent incisors in 6-7-year-old students at Candijati 01 Elementary School, Arjasa District, Jember Regency. The findings reveal that students with normal nutritional status tend to have more erupted lower permanent incisors compared to those with undernutrition or overnutrition. The majority of students with normal nutrition had a higher number of erupted teeth, emphasizing the importance of adequate and balanced nutrient intake in supporting optimal tooth eruption in children. These results underscore the need for promoting good nutritional practices to ensure healthy dental development. The study provides valuable insights for parents and healthcare providers to monitor and improve the nutritional status and dental health of children, highlighting the critical role of nutrition in the timely eruption of permanent teeth. The findings also suggest that special attention should be given to children with undernutrition or overnutrition to support their dental growth and development.

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