ORIGINAL ARTICLE

Relationship of Nutritional Status With Incidence of Permanent Mandibular First Molar Caries

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ABSTRACT

Introduction: Nutritional status is a condition of the body which is the result of a balance between food intake and nutritional needs. Good nutritional status is very important for children, but in reality there are still many malnourished children. Lack of nutrition and the habit of consuming excess food can make teeth susceptible to caries. The tooth with the highest caries incidence is mandibular first molar which is the most important tooth in mastication process. The purpose of this research is to determine the relationship between nutritional status and the incidence of caries in permanent mandibular first molar children aged 7 years in Plalangan Village, Jember, East Java, Indonesia. **Methods:** This is an analytic observational research with a cross-sectional approach. The sampling technique of this research is Total Sampling, which uses the entire population as the sample of this study. This research was conducted by measuring the nutritional status of BMI-for-age based on anthropometric standards from the Minister of Health of the Republic Indonesia No. 2 of 2020 and examining the oral cavity to see whether there is caries or not in the permanent mandibular first molar. **Results:** The results of the Chi-Square Test showed a value of 0.036. **Conclusion:** The result shown that thinness and overweight children have a higher caries incidence than normal weight children. There is a significant relationship between nutritional status and incidence of permanent mandibular first molar caries.
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Keywords: Children aged 7 years, Dental caries, Nutritional status, Permanent mandibular first molar

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INTRODUCTION

Nutritional status is a condition which is the result of a balance between nutrient intake from food and the nutritional needs for body metabolism (1). Nutrients are needed by the body as a source of energy, maintenance of body tissues, growth, and regulator of body processes. Inadequate intake of nutrients in children can lead to impaired child development (2). Anthropometry is one of the indicator of nutritional status. Body Mass Index for age (BMI-for-age) can be used to determine the prevalence of nutritional status of school children and adolescents (3). Riskesdas 2018 shows the Indonesian prevalence of nutritional status of children aged 5-12 years, including 2.4% severe thinness, 6.8% underweight, 10.8% overweight, and 9.2% obesity (4).

Children need adequate intake of nutrition to help optimize their growth and development stages. The level of nutrient consumption is not only related to nutritional status but also related to the severity of dental caries (5). Aulia, et al. (2019) states that there is a relationship between nutritional status and dental caries which is indicated by obese children suffering from dental caries higher than children with normal weight (3).

The prevalence of caries, from Riskesdas 2018, shows that children aged 5-9 years have a quite high caries number at 92.6% (4). The main causes of dental caries are substrate, microorganism, host, and time. The initial process of caries formation is the fermentation process of food residues in the oral cavity. The fermentation process is caused by bacteria that convert sugar into organic acids that can cause caries or cavities in the long term (6).

The incidence of caries in permanent teeth mostly occurs in the mandibular first molars. Aulia, et al. (2019) stated that the highest percentage of dental caries was 65.77%, in the permanent mandibular first molars. The anatomical shape of the permanent mandibular first molar is easy to be a place for food retention so that it is at risk for dental caries (3).

Nutrition plays a role in the development of teeth. Lack of nutrients, calcium and fluoride, can result in tooth decay, especially enamel so that it can encourage the occurrence of dental caries in children (7-9). Children who consume excessive amounts of food, especially cariogenic foods such as carbohydrates and sugar, also make it easier for children to get dental caries. Cariogenic food consumed by children will be fermented by bacteria into lactic acid which can demineralize enamel and dentin (3, 10). Prisinda (2017) stated that children aged 7 years are usually not able to make efforts to maintain their health independently. The level of knowledge and awareness of children about oral health is also still lacking, besides that food intake is still strongly influenced by the family and school environment. Uncontrolled food intake, such as consuming a lot of carbohydrates or sugar and consuming less protein, vitamins and minerals, will facilitate the occurrence of dental caries in children (11).

Kalisat District (2019) has a fairly high prevalence of thinness and severe thinness of toddlers in Jember Regency, East Java, Indonesia. This district has a prevalence of thinness of 17%, severe thinness of 10.2%, and overweight of 6.1%. Data from the Kalisat Health Center 2020 shows that Plalangan Village has many thinness and severe thinness under-fives with a total of 31 toddlers, and 32 overweight children (12). This description is the basis for the author to examine the relationship between nutritional status and the incidence of caries in the permanent mandibular first molar in children aged 7 years in Plalangan Village, which is a village with quite high malnutrition problems in Jember Regency.

MATERIALS AND METHODS

This research is an analytic observational study with a Cross-Sectional approach. This research was conducted in Plalangan Village, Kalisat District, Jember Regency in March 2021. The population was all children aged 7 years in Plalangan Village, Kalisat District, Jember Regency, totaling 54 children who were allowed by their parents or guardians whom filling out informed consent. The sampling technique of this research is Total Sampling. Total Sampling is taking the entire population to be used as a sample, so the research sample is 54 children (14). The ethical approval for this study was obtained from The Ethical Committee of Medical Research Faculty of Dentistry Universitas Jember - No.1188/UN25.6/KEPK/DL/2021.

Data was collected by direct measurement of the child's weight and height to determine their nutritional status. This measurement is done by 4 operators. Measurement of body weight using a digital weight scale. Weighing the child is done by taking off his footwear, then positioning the child on the scale with a straight face and looking straight ahead. The measurement results will be visible in the scale reading window. Measurement can be done twice to ensure that the measurement results seen are correct. Measurement of children's height using a microtoise measuring instrument. Children are not allowed to wear footwear and hair ornaments when measuring their height. The measurement of the child's height is done by positioning the child to stand upright, sticking to the wall, and looking straight ahead. The head of the microtoise is pulled straight until it touches the child's head, then record the measurement results printed on the head of the microtoise (32).

The calculation of the nutritional status of BMI-for-age is done by entering data on the child's weight and height in the formula below (33):

$$BMI = \frac{Weight\ (kg)}{Height\ (m^2)}$$

The results of the BMI measurement are compared with the BMI-for-age table from the Minister of Health of the Republic of Indonesia Number 2 (2020) according to the age and gender of each child (13).

The dental caries examination of the permanent mandibular first molar using a mouth mirror to see whether there is caries or not, while the child sits upright on the chair. Recording the results of the examination by selecting one of the first permanent mandibular first molars right or left with caries. Dental caries is the condition of cavities and/or teeth having white spots (3, 11).

Data processing uses the Statistical Package for the Social Sciences (SPSS). Data analysis is presented in a frequency table to get an overview of each variable. Chi-Square Statistical Test is used to examine the relationship between nutritional status and the incidence of caries in the permanent mandibular first molar of children aged 7 years (3).

RESULTS

This research was conducted on children aged 7 years in Plalangan Village, Kalisat District, Jember Regency, East Java, Indonesia, totaling 54 children. Table I shows the distribution of the sample by gender.

The results of quantitative data of children aged 7 years based on gender obtained from the table above indicate that the number of boys is equal to the number of girls. Each of the numbers of boys and girls is 27 children (50%). Each child who came later was measured for weight and height to calculate Body Mass Index (BMI). The results of grouping the nutritional status of the sample are presented in Table II.

Table II shows the results of measuring the nutritional

Table I: The distribution of children by gender

Gender	n	%
Boy	27	50
Girl	27	50
TOTAL	54	100

Table II: The distribution of children by nutritional status (BMI-for-aged)

Nutritional Status	n	%
Severe Thinness	0	0
Thinness	5	9.3
Normal	43	79.6
Overweight	6	11.1
Obesity	0	0
TOTAL	54	100

status of 7-year-old children in Plalangan Village, consisting of no severe thinness children, 5 thinness children (9.3%), 43 normal weight children (79.6%), 6 overweight children (11.1%), and no obese children. Based on these data, the number of normal weight children is the most, followed by the number of overweight children, and thinness children. The grouping of the number of children aged 7 years in each category of nutritional status based on gender is presented in Table III.

Table III shows the distribution of the number of boys

Table III: The distribution of children in each category of nutritional status (BMI-for-aged) by gender

Nutritional Status	Boy		Girl	
	n	%	n	%
Severe Thinness	0	0	0	0
Thinness	2	7.4	3	11.1
Normal	22	81.5	21	77.8
Overweight	3	11.1	3	11.1
Obesity	0	0	0	0
TOTAL	27	100	27	100

aged 7 years in Plalangan Village, consisting of no severe thinness children, 2 thinness children (7.4%), 22 normal weight children (81.5%), 3 overweight children (11.1%), and no obese children. The number of girls consists of no severe thinness children, 3 thinness children (11.1%), 21 normal weight children (77.8%), 3 overweight children (11.1%), and no obese children. Based on these data, it can be seen that there is no difference in nutritional status between girls and boys.

Children whose weight and height had been measured to determine their nutritional status were then examined for caries on the permanent mandibular first molars. The distribution of the number of children based on the presence or absence of caries in the permanent mandibular first molars is shown in Table IV.

The results of the quantitative data obtained in table IV above are 29 children (53.7%) who have caries on the permanent mandibular first molar and 25 children (46.3%) who do not have caries on these teeth. The table

Table IV: The distribution of children based on the presence and absence of caries in the permanent mandibular first molar

Caries	n	%
Caries	29	53.7
No Caries	25	46.3
TOTAL	54	100

above shows the number of children who have caries on the permanent mandibular first molars is greater than children who do not have caries on these teeth.

The results of the quantitative data obtained in Table V above show the number of boys who have caries on the permanent mandibular first molars as many as 15 children (51.7%) and girls who have caries on these teeth as many as 14 children (48.3%). The number of boys who do not have caries on the mandibular permanent first molars was 12 children (48%) and girls who do not have caries on these teeth were 13 children (52%). The table above shows that the number of boys who have

Table V: The distribution of children with the presence or absence of caries in the permanent mandibular first molar by gender

Gender	Caries		No Caries	
	n	%	n	%
Boy	15	51.7	12	48
Girl	14	48.3	13	52
TOTAL	29	100	25	100

caries in the lower permanent mandibular first molars is higher than in girls, while children who mostly do not have caries on that teeth are girls. The distribution of the number of children with caries in the mandibular permanent first molars based on their nutritional status is shown in Table VI.

Table VI shows the distribution of the number of children who have caries in the permanent mandibular first molar consisting of no severe thinness children, 4 thinness children (13.8%), 20 normal weight children (69%), 5 overweight children (17.2%), and no obese children. The number of children who do not have caries on these teeth consists of no severe thinness children, 1 thinness child (4%), 23 normal weight children (92%), 1 overweight child (4%), and no obese children.

The data from the measurement of nutritional status and caries examination of the mandibular first molar were tested for correlation using the Chi-Square Statistical Test to test whether there was a relationship between the two variables or not. The nutritional status variable was compressed into two categories to qualify the statistical test. The nutritional status variable consisted of 5 categories, but only three categories represented the nutritional status of the sample, thinness, normal, and overweight. These variables were compressed into two categories, normal category for normal nutritional status and abnormal category for thinness and overweight (15).

Table VI shows that the significance value resulting from the Chi-Square correlation test is 0.036. This value is less than 0.05 (p<0.05), which means that there is a significant relationship between nutritional status (BMI-for-age) and the caries incidence of the permanent mandibular first molar in children aged 7 years in Plalangan Village, Kalisat District, Jember Regency East Java, Indonesia.

Table VI: The relationship between nutritional status (BMI-for-aged) and the incidence of caries in the permanent mandibular first molar by Chi-Square Test

Nutritional Status	Caries		No Caries		p-value
	n	%	n	%	
Severe Thinness	0	0	0	0	
Thinness	4	13.8	1	4	
Normal	20	69	23	92	
					0.036
Overweight	5	17.2	1	4	
Obesity	0	0	0	0	
TOTAL	29	100	25	100	

DISCUSSION

The purpose of this research is to determine the relationship between nutritional status and the incidence of caries in the permanent mandibular first molars of 7-year-old children in Plalangan Village, Jember, East Java, Indonesia, consisting of 27 boys (50%) and 27 girls (50%). This number is not much different from the results of the 2020 population census in Jember Regency which shows the percentage of the male population is 49.87% and the female population is 50.13% (16). This condition shows that population growth between males and females is balanced in Jember Regency, especially in Plalangan Village, Kalisat District for children aged 7 years.

Table II shows that there are no severe thinness and obese children aged 7 years in Plalangan Village. This condition is good compared to the national prevalence of severe thinness nutritional status according to Riskesdas 2018 which is 2.4% and obesity is 9.2%. The percentage of thinness children in Table II is higher than the data of Riskesdas (2018) which shows the national prevalence of thinness children aged 5-12 years of 6.8% and is also higher than the prevalence of thinness nutritional status in East Java which is 5.8% (4). This condition shows that the problem of thinness nutritional status in school-age children, especially 7 years old in Plalangan Village, is still quite high because it is above the national and East Java province prevalence in 2018.

The number of normal weight children is 43 children or 79.6% of the total sample. This condition is very good because this percentage is higher than the national prevalence of normal nutritional status according to Riskesdas (2018), which is 70.8%. This prevalence is also much higher than the number and percentage of thinness and overweight children in Plalangan Village. The percentage of overweight children aged 7 years in Plalangan Village is 11.1%. This percentage is higher than the national prevalence according to Riskesdas (2018) data, which is 10.8% but lower than the prevalence in East Java which is 13.2% (4).

Nutritional problems in children cannot be underestimated. Malnutrition in children is caused by many factors. The direct factors that cause children to experience malnutrition are poor nutritional intake and infectious diseases. Lack of nutritional intake can cause the nutritional elements needed in the body not to be fulfilled, while infectious diseases cause impaired function in body organs so that the absorption of food substances in the body is disturbed. Indirect factors that cause malnutrition in children can be caused by poor parenting, poor sanitation, and inadequate basic health services (2).

Data of Indonesian Statistical Center (2020) shows as many as 2,660 households in Plalangan Village work

in agriculture (16). This condition can illustrate that the people in Plalangan Village have a low socio-economic level. The socio-economic level includes education, employment, and income (17). Utami (2018) states that family income affects the adequacy and quality of food for children. Families with low incomes will tend to buy any food and do not pay attention to the quality of food so that it will affect the child's nutrition to be abnormal. This kind of family usually has thinness children (18).

Apart from being thinness, being overweight is also a problem that cannot be ignored. Overweight in children is caused by the number of calories consumed more than calories expended for activity. One of the factors causing overweight in children is physiological factors. Physiological factors can be hereditary or non-hereditary. Hereditary factors are heredity factors, while non-hereditary factors include diet, level of nutritional intake, level of physical activity, and socio-economic conditions (19).

Distribution of children aged 7 years in each category of nutritional status by gender show that there is one more thin girl than boys. Girls will usually try to maintain an ideal body shape by limiting food intake. This condition has an impact on the nutritional status of children to be less (20). However, the number of thinness boys is not much different from the number of thinness girls. Boys more often have high physical activity and drain a lot of energy so that there is usually an imbalance between the energy that comes in from food and the energy that goes out for activities (20, 21).

The data of normal weight children are also not much difference between boys and girls. The number of normal weight children consisted of 22 boys and 21 girls. This condition is quite good when compared to another nutritional status, the number of normal nutritional status is 43 children. Good nutrition is very important for a child. Normal nutritional status in children is the foundation of health that can affect immunity, susceptibility to disease, as well as physical and mental growth and development to improve the quality of human resources (22).

The number of overweight children is the same between boys and girls, namely 3 children each. Anita (2018) mention in her article that females have thicker fat tissue and skin folds than males so that females look fatter (20). Boys are at the same risk of being overweight as girls. Intake of energy, fat, and carbohydrates in boys is quite a lot because boys pay less attention to appearance than girls (23). Males and females have equal opportunities in food consumption and there is no relationship between nutritional status and gender, so both males and females have the same risk of experiencing overweight nutrition (24).

The fulfillment of nutrition in children is very important.

Nutrients such as protein, calcium, phosphate, vitamin C, and vitamin D are nutrients needed in the formation of a healthy and perfect tooth structure. The level of consumption of macronutrients and micronutrients is not only related to nutritional status but also related to the severity of dental caries (5).

The national dental caries prevalence according to Riskesdas 2018 for children aged 5-9 years is 92.6% (4). Aulia, et al. (2019) stated that the highest percentage of dental caries was in the permanent mandibular first molar with a percentage of 65.77% (3). This percentage is not much different from the data from the caries measurement of the permanent mandibular first molar in children aged 7 years in Plalangan Village which is shown in Table IV. The number of children who have caries in their permanent mandibular first molar shows that the problem of dental caries is still quite high for children aged 7 years in Plalangan Village. The Data of Indonesian Statistical Center (2020) shows that there are no hospitals or clinics in this village (16). This condition makes it difficult for the people of Plalangan Village to look for treatment because of the unavailability of health facilities in their village. The low awareness of children and lack of attention from parents to children's dental and oral health can also be a factor causing the high prevalence of caries in children (6). The role of parents is very necessary in shaping children's behavior, for example providing understanding, reminding, and providing facilities to children so that they can maintain dental and oral hygiene to avoid caries and other oral diseases (34).

Caries can occur because food is easily attached to or retained in the anatomical shape of the permanent mandibular first molar which has pits and fissures. The accumulation and retention of plaque that is formed allow the process of carbohydrate fermentation by bacteria to become acids that can destroy dental apatite crystals (3). Cavity in the sample molars was indicated by the presence of small holes and blackish-brown color. Small holes or blackish brown color found in the first permanent mandibular molars in the carious samples were mostly found in the pits and fissures of these teeth.

The number of boys who had caries in their molars consisted of 15 children (51.7%). These data are not much different from girls who have caries on the teeth, namely as many as 14 children (48.3%). The number of children who do not have caries on the molars was not much difference between boys and girls, namely 12 boys (48%) and 13 girls (52%). These data indicate that both boys and girls have a risk that is not much different from the occurrence of dental caries (3). Factors such as low economic level and education of parents, the habit of maintaining oral health, the food consumed, and the frequency of visit to dental and oral health services varies greatly in each individual, both male and female, so that it can affect the possibility of caries (26).

Thinness children who have caries in the permanent mandibular first molars are more than those who do not have caries on these teeth. Hamid & Yauri (2019) stated in their journal that nutritional deficiencies such as carbohydrates, protein, iron, zinc, calcium, phosphorus, folic acid, vitamin D, and vitamin C can cause abnormalities in the teeth and jaw (5). Lack of these nutrients during the formation of teeth can cause imperfect enamel formation or hypoplasia so that it affects the caries susceptibility of the teeth (8). The Indonesian Dentist Association states that at least 89% of people with cavities are children under 12 years old. Lack of vitamins and minerals, especially calcium and fluoride, promote dental caries in children (7).

Normal weight children who do not have caries in the permanent mandibular first molars are more than children who have caries on these teeth. Normal weight children have adequate nutritional intake, especially protein, calcium, phosphate, vitamin C, and vitamin D, which support the formation of perfect tooth structure in children (5). The number of children with caries is not small either. This condition is caused by multifactorial dental caries which can be influenced by socioeconomic status, diet, tooth brushing habits, and others (25). These factors can also affect the occurrence of dental caries even though their nutritional status is normal.

The number of overweight children who have caries on the permanent mandibular first molars is higher than the number of children who do not have caries on these teeth. This condition is in accordance with the theory which states that the frequency of excessive carbohydrate consumption is generally the cause of overweight and obese children experiencing dental caries. The high consumption of cariogenic foods in a long time in overweight and obese children can cause bacteria to ferment a lot of sucrose (sugar) into lactic acid which will lower the oral pH to a critical pH (5.5). This condition causes demineralization of enamel and dentin (10). Zakiyah, et al. (2017) stated that nutritional intake also affects the growth and development of teeth. Overweight children show faster growth and development of teeth than normal weight children so that tooth eruption is also faster (9). This condition allows the permanent mandibular first molar teeth to be exposed to caries factors longer than children with normal nutrition (25).

The relationship of nutritional status (BMI-for-age) with the incidence of caries in permanent mandibular first molar in children aged 7 years in Plalangan Village, Jember, East Java, Indonesia, is significance based on the stated value, which is 0.036. This result is in accordance with the theory which states that nutrition plays a role in tooth growth and maintaining the balance of the oral environment. Nutrition for optimal growth of teeth is the same as the nutrients needed by the body because the period of tooth growth is in line with the period of

growth of the body as a whole (5).

Nutrition plays a role in every stage of tooth development (9). Lack of nutrients can result in enamel hypoplasia so that the teeth are susceptible to caries after the eruption (8). Lack of calcium and fluoride, especially in children under 12 years of age, also encourages caries in children's teeth (7). Overweight can also cause caries through the fermentation of carbohydrates or sugars by bacteria that are consumed by children so that it can cause cavities (10).

Hendarto (2015) states that oral health and body health influence each other. Proper nutrition can maintain optimal oral health and good oral health can also maintain adequate nutritional intake for the body (27). Dental caries can also caused thinness or even severe thinness in children. Dental caries that is left untreated will result in a toothache (28). Pain caused by dental caries, especially in the permanent mandibular first molar which is the key to occlusion, results in disruption of the masticatory system thereby reducing food intake in children. The lack of nutritional intake consumed by children affects the nutritional status of children becoming thin or severe thinness (29). Alkarimi, et al. (2014) stated that infected dental pulp can affect immunity and erythropoiesis which can cause anemia, affect bone formation, sleep patterns, and food intake. These data are supported by the results of a trial of treatment of severe caries in children ages 6 to 7 which significantly increase their appetite. Sleep disturbances caused by pain and infection of the teeth also affect the imbalance of growth hormone secretion and disruption of the absorption of nutrients in the body (30). Unfortunately, this study did not discuss how the severity of caries and longevity of caries progress can affect the nutritional metabolism of children's bodies due to time constraints.

Parental control is closely related to food consumption and children's dental and oral health behavior. Parents also play a role in taking care of their children's teeth to the dentist. Children should be taken regularly to the dentist every 6 months with the aim of knowing or detecting early development and growth of teeth and their treatment if needed. Mothers should also actively check the child's teeth and mouth for the presence of tooth mobility, cavities, and abnormal tooth growth (34). If parents do not take preventive action on dental health behavior and control food consumption, then the child tends to experience dental caries along with being overweight or obese (31). Fankari (2018) states that diet greatly affects the child's growth and development patterns in meeting the nutrients in their bodies (28).

CONCLUSION

The results showed that there was a significant relationship between nutritional status and the incidence

of caries in the permanent mandibular first molar in children aged 7 years in Plalangan Village, Jember, East Java, Indonesia, which was indicated by thinness and overweight children having a higher level of dental caries compared to the normal weight children. These results indicate that nutritional status has the potential to affect dental caries susceptibility in children, and vice versa. However, both nutritional status and caries have various causative factors. Therefore, children with dental caries do not always have an abnormal nutritional status. It is hoped that further research can explain more about other factors that are more influential.

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