

The Relationship between Nutritional Status and the Occurrence of Dental Caries in Elementary School Children at Wonosaren State Elementary School

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ABSTRACT

Introduction: Dental and oral health problems in Central Java province are still high, namely 73.4% of children aged 10-14 years, and are ranked 22nd province in Indonesia. Nutritional status, oral hygiene, and diet can cause dental caries in children. Several studies report a relationship between nutritional status and dental caries. This study aims to describe and analyze the relationship between nutritional status and the occurrence of dental caries in elementary school-aged children at Wonosaren State Elementary School. **Method:** This research is an observational analytical study with a cross-sectional approach. This research was carried out in August-September 2023. The sample was selected using stratified random sampling of 100 research subjects. Nutritional status was measured using the BMI/Age technique, obtained from anthropometric weight and height measurements. Weight is measured using a step scale, and height is measured using a microtome. A dental caries examination is carried out by inspection and dental condition. Data were analyzed using the Statistical Program for Social Science (SPSS) version 25. It was analyzed using the Pearson correlation test to determine the relationship between nutritional status and the occurrence of dental caries. Results are declared significant if $p < 0.05$. **Results:** Pearson correlation test showed no relationship between nutritional status (BMI/U) and dental caries ($p = 0.179$). **Conclusion:** There is no relationship between nutritional status and the occurrence of dental caries in elementary school-aged children at SD Negeri Wonosaren.

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INTRODUCTION

Primary school-aged children are a vulnerable group for nutritional problems. The nutritional quality of primary school children needs to be considered because adequate nutrition during this period has long-term effects on their optimal growth and development (Muchtar *et al.*, 2022). According to RISKESDAS in 2018, children in Indonesia aged 5-12 years obtained a nutritional status of thinness of 9.3%, children who were overweight were 20.6%, and there were 23.6% short children (Riskesdas, 2018). The nutritional condition of primary school-age children is generally better than that of toddlers. However, school-age children still have poor nutritional conditions (Hasrul *et al.*, 2020).

Cavities or dental caries are diseases of the teeth and mouth that can affect human health (Novriani *et al.*, 2022). Tooth morphology, tooth structure, salivary acidity, tooth arrangement in the jaw, as well as the frequency and habit of brushing teeth that have an impact on oral hygiene are factors in the mouth that have a direct effect on the onset of dental caries in children (Novriani *et al.*, 2022). Nutritional status, consumption of sugary drinks, vegetarian diet, and deficiency of some minerals and vitamins such as vitamins A, B, C, and D, zinc and fluorine are other factors that can cause dental caries in school-age children (Damayanti *et al.*, 2020). Riskesdas data in 2018 shows that school-age caries are still prevalent in Indonesia. As much as 92.6% is found in children aged 5-9 years and 73.4% in children aged 10-14. Oral health problems in Central Java province are ranked 22nd in Indonesia, at 56.7% (Riskesdas, 2018).

International research shows a relationship between nutritional status and dental caries, with the result that obese children suffer from dental caries more often than children who have normal BMI. Another study found no significant difference in DMFT/deft scores in each nutritional category of children (Aulia *et al.*, 2019). In a study (Mirawati & Yauri, 2019) at SDN 39 Tamalang, it was found that the relationship between dental caries and nutritional status was very strong because children with low nutritional status tended to have high caries. Meanwhile, research (Riswandi *et al.*, 2016) found that children with more nutritional status will experience more caries due to the consumption of too many carbohydrates.

Based on this description, the authors are interested in researching the relationship between nutritional status and the occurrence of caries in elementary school children at Wonosaren State Elementary School. This research was conducted with a different approach from previous studies regarding location and research subjects. Researchers chose Wonosaren Elementary School because, after several surveys in the field, Wonosaren Elementary School students have a habit of eating sweet foods, instant foods, and packaged sweet drinks. The socio-economic status of the parents of Wonosaren Elementary School students is also primarily middle to lower class. This study aims to determine the description of nutritional status and the incidence of dental caries and analyze whether there is a relationship between nutritional status and the occurrence of dental caries in elementary school children at Wonosaren State Elementary School.

LITERATURE REVIEW

Dental caries is a chronic disease that causes destruction and demineralization of the hard tissues of the teeth due to acid production that occurs from bacterial fermentation of food (Tahir & Nazir, 2018). Dental caries is a multifactorial disease with the main factors being bacteria adhering to all tooth surfaces, fermentable carbohydrates from food, and the host or tooth surface over time. *Streptococcus mutans*, *Streptococcus sobrinus*, and *Lactobacillus species* are the bacteria identified as the main causative agents in this process, leading to cavitation and possible tooth loss (Darby and Walsh, 2014). According to the WHO

definition, dental caries is a local pathological process with an extrasomatic background, which causes decalcification of tooth enamel, decay of dental hard tissues, and consequent formation of dental cavities. Dental caries is also a serious problem because it causes complaints of pain, besides that dental caries can spread infection to other parts of the body as a result of decreased productivity (Rokayah et al, 2017).

Nutritional status is a condition caused by the balance between the body's need for nutrients and the intake of nutrients from food. Nutrient consumption has a significant impact on nutritional status. There are two factors that can affect the utilization of nutrients by the body, namely primary and secondary factors (Par'i *et al.*, 2017). The state of the human body as a result of eating and using nutrients is known as nutritional status. Food consumption and the state of body health or infection are among the two main factors that can affect the good or bad nutritional status of a person. In nutrition science, overnutrition and undernutrition are referred to as unhealthiness, which is a neurotic condition due to a deficiency or excess of at least one supplement (Mardalena, 2021). Malnutrition is an abnormal physiological condition resulting from inadequate, unbalanced or excessive consumption of macronutrients that provide dietary energy (carbohydrates, protein and fat) and micronutrients (vitamins and minerals). Macronutrients and micronutrients are essential for physical and cognitive development. Malnutrition includes undernutrition as well as overnutrition (overweight and obesity), often combined with micronutrient deficiencies. (Trentmann *et al.*, 2015).

Nutrition and diet are critical in the development, growth and maintenance of oral tissues. In addition, the condition of the mouth can also influence food choices and ultimately affect nutritional status. Nutritional deficiencies can affect enamel maturation and composition, as well as tooth morphology and size (Adeniyi *et al.*, 2016). Since the growth period of teeth is in line with the growth period of the body as a whole, the nutrients for optimal tooth growth are the same as the nutrients required by the body. Minerals (starch, magnesium, phosphorus and calcium), vitamins (vitamins A, C and D), water and protein are nutrients required for tooth development (Novriani *et al.*, 2022). Absorption of phosphorus, magnesium and calcium from the gastrointestinal tract requires vitamin D for healthy tooth development and bone mineralization. Vitamin D sufficiency can support salivary flow rate leading to more effective anti-caries action of saliva. Decreased parotid gland function and decreased salivary production have been associated with vitamin D deficiency (Alhelfi & Hoobi, 2023).

Proper nutrition is essential for maintaining dental health. On the other hand, dental health is also vital for adequate nutritional intake. Salivary buffer capacity will decrease if you consume too much sucrose, which can ultimately increase the occurrence of caries. Consuming foods/drinks with high sugar content, snacks, and fast food between meals can increase dental caries (Novriani *et al.*, 2022).

METHOD

The design of this study was observational analytic with a cross-sectional design. The research was conducted at Wonosaren State Elementary School in August-September 2023. The study population was students at Wonosaren State Elementary School, totaling 232 students. The sampling was done using a stratified random sampling technique with as many as 100 research subjects. The inclusion criteria are children aged 6-12 years who brush their teeth at least 2 times a day and whose parents are willing to be research subjects. Exclusion criteria are children who cannot be invited to cooperate.

The independent variable in this study is nutritional status with BMI per Age measurement. The dependent variable to be studied is dental caries with the deft/deft

assessment instrument. Data collection is preceded by consenting and filling in the child's data. After that, an anthropometric examination will be carried out in the form of weight and height measurements and caries examination. Height checks were carried out three times using a microtome, with the student standing upright against the wall without using footwear in a straightforward position, with both knees and heels tight against the wall. Body weight checks are carried out three times using a stepping scale with the position of the child standing on the stepping scale barefoot, wearing the minimum clothing possible by removing outer clothing such as jackets and accessories, removing the contents of the pockets, and staying still, not moving. Based on PMK no 2 of 2020, the nutritional status of children is divided into several categories based on age. Children aged 5-18 years use the Body Mass Index according to Age (BMI/ Age) with classifications, namely poor nutritional status for z-score values < -3 SD, undernutrition for z-score values ≥ -3 SD to < -2 SD, normal nutrition for z-score values ≥ -2 SD to ≤ 1 SD, overnutrition for z-score values > 1 SD to ≤ 2 SD, obesity for z-score values > 2 SD. Dental caries examination is carried out by inspection and foundation based on the DMFT/def-t instrument to see black areas or cavities formed. DMF-T consists of (D) cavities, (M) missing or extracted teeth, and (F) filled teeth. The def-t component criteria are the same as the DMF-T criteria, except that it is used for primary teeth where (e) is a tooth indicated to be extracted due to dental caries. WHO classifies the severity of dental caries into five categories, which are as follows: 1) DMF-T/def-t values of 0.0-1.0 indicate very low severity; 2) A DMF-T/def-t value of 1.2-2.6 indicates low severity; 3) A DMF-T/def-t value of 2.7-4.4 indicates moderate severity; 4) A DMF-T/def-t value of 4.5-6.5 indicates high severity; 5) A DMF-T/def-t value of > 6.6 indicates very high severity.

The data was entered into the SPSS 25 software program. The data was analyzed using the Kolmogorov-Smirnov test to determine whether the data distribution was normal or abnormal. The data will generally be distributed if the sig value is > 0.05 . The data is not normally distributed if the sig value is < 0.05 . After that, the statistical technique to be used if the data is not normally distributed can use the Spearman Rank correlation. In contrast, the Pearson correlation can be used if the data is usually distributed.

Confounding variables are also examined as other factors that affect the dependent variable. This study determined gender, tooth brushing habits, and meal frequency as confounding variables. The Chi-Square test was conducted to test the relationship between the confounding and dependent variables. In the habit of brushing teeth, a questionnaire instrument was used, which was divided into a "bad" category, namely $<$ the median value, and a "good" category, namely $\geq$ the median value with a median value of 29, and the frequency of eating used the FFQ instrument, divided into two categories, namely "insufficient" $<$ the median value and "sufficient" $\geq$ the median value with a median value of 14.19.

RESULT AND DISCUSSION

The eligible research samples were Wonosaren Elementary School students in grades 1, 2, 3, 4, and 5 aged 6-12 years, totaling 100 children. In the table 1, it can be seen that there are more boys (male), namely 55 children (55%) while girls (female) are 45 people (45%). In the table of children's age, the results obtained with the highest age group are 8 years old and 10 years old as many as 24 children (24%). In the dental caries variable, the high number of samples was found in the "very low" severity category for the dmf-t value of 0-1.1 as many as 29 children (29%). In the nutritional status variable with BMI/ Age assessment using Z-Score, the highest number of samples was found in the "Normal" category for z-score values ≥ -2 SD to ≤ 1 SD, namely 69 children (69%). In the tooth brushing

habits variable, the results of children's tooth brushing habits were found to be good, namely 54 children (54%). In the variable frequency of eating children in Wonosaren State Elementary School, the results were obtained in the "sufficient" category of 51 children (51%).

Table 1. Characteristics of subjects

Variable Characteristics	Frequency	Percentage (%)
Gender		
Male	55	55
Female	45	45
Age (years)		
6	6	6
7	12	12
8	24	24
9	19	19
10	24	24
11	14	14
12	1	1
Dental Caries (severity)		
Very low	29	29
Low	10	10
Moderate	17	17
High	21	21
Very high	23	23
Nutritional Status		
Poor	0	0
Undernutrition	2	2
Normal	69	69
Overnutrition	12	12
Obesity	17	17
Tooth Brushing Habits		
Bad	46	46
Good	54	54
Meal Frequency (FFQ)		
Insufficient	49	49
Sufficient	51	51

Table 2. Normality Test

One-Sample Kolmogorov-Smirnov	Unstandardized
N	100
Asymp. Sig (2-tailed)	0.26

Based on the statistical test results, the significance is 0.26. From these results the sig value > 0.05 which indicates that the data is normally distributed, so the correlation test to be used is Pearson correlation (Table 2). Table 3 shows the results for the Pearson correlation test with a significance value of 0.179 ($p > 0.05$), which means that nutritional status and dental caries have a negative correlation or inverse relationship. The correlation coefficient value is 0.039 which means a positive correlation with a very low correlation (0.00-0.199). In table 3, it can be seen that the relationship between nutritional status and dental caries of all samples totaling 100 children was found that children with undernutrition status had a "high" caries category of 1 child (1%), and "very high" as many as 1 child (1%). Children with normal nutritional status had "very low" caries as many as 17 children (17%) "low" as many as 7 children (7%), "moderate" as many as 13 children (13%), "high" as many as 15 children

(15%), and “very high” caries category as many as 17 children (17%). Children with overnutrition nutritional status have a dental caries category of “very low” as many as 6 children (6%), “low” as many as 2 children (2%), “moderate” as many as 2 children (2%), and “very high” as many as 2 children (2%). Children with obesity nutritional status have a dental caries category of “very low” as many as 6 children (6%), “low” as many as 1 child (1%), “moderate” as many as 2 children (2%), “high” as many as 5 children (5%), and “very high” as many as 3 children (3%).

Table 3. Relationship between Nutritional Status and Dental Caries (N= 100)

Nutritional Status	Dental Caries (Severity)					Total	p-value	r
	Very low	Low	Moderate	High	Very High			
Poor	0	0	0	0	0	0		
Undernutrition	0	0	0	1	1	2		
Normal	17	7	13	15	17	69	0.179	0.039
Overnutrition	6	2	2	0	2	12		
Obesity	6	1	2	5	3	17		

Table 4. Chi-Square Analysis Results Gender Relationship with the Occurrence of Dental Caries (N= 100)

Dental Caries	Gender				Total		P
	Male		Female		N		
	n	%	n	%			
Very low	13	13	16	16	29	29	0.584
Low	7	7	3	3	10	10	
Moderate	11	11	6	6	17	17	
High	11	11	10	10	21	21	
Very high	13	13	10	10	23	23	

Table 4 shows non-significant results with a p value = 0.584 ($p > 0.05$). In boys (male), the largest percentage of dental caries was found in the very low and very high categories, totaling 13%. This was followed by the moderate and high categories at 11%. The smallest percentage of boys with dental caries was found in the low category at 7%. In girls, the largest percentage of dental caries was found in the very low category (16%). This was followed by the high and very high categories, which were 10%. Then a percentage of 6% was found in the moderate category. The smallest percentage of boys with dental caries was found in the low category (7%).

Table 5. Chi-Square Analysis of the Relationship between Meal Frequency and the Occurrence of Dental Caries (N= 100)

Dental Caries	FFQ				Total		P-value
	Insufficient		Sufficient		N		
	n	%	n	%			
Very low	14	14	15	15	29	29	0.649
Low	7	7	3	3	10	10	
Moderate	9	9	8	8	17	17	
High	9	9	12	12	21	21	
Very high	10	10	13	13	23	23	

Table 5 shows non-significant results with a value of $P = 0.649$ ($p > 0.05$). The percentage of dental caries occurrence in children with a low meal frequency is mostly found in the very low category (14%). Followed by very high (10%), high (9%), moderate (9%), and low

(7%) categories. The percentage of dental caries incidence in children with sufficient food frequency is mostly found in the very low category (15%). Followed by very high (13%), high (12%), and moderate (3%) categories.

Table 6. Chi-Square analysis of the relationship between tooth brushing habits and the occurrence of dental caries (N= 100)

Occurrence of dental caries (N = 100)							
Dental Caries	Tooth Brush Habits				Total		P-value
	Bad		Good				
	N	%	n	%	N	%	
Very low	14	14	15	15	29	29	0.641
Low	6	6	4	4	10	10	
Moderate	7	7	10	10	17	17	
High	11	11	10	10	21	21	
Very high	8	8	15	15	23	23	

Table 6 shows non-significant results with a P value of >0.641 ($p>0.05$). Children with poor brushing habits with very low dental caries have a percentage of 14% and children with good brushing habits with very low dental caries have a percentage of 15%. Children with poor brushing habits with low dental caries had a percentage of 6% and children with good brushing habits with low dental caries had a percentage of 4%. The habit of brushing teeth of bad children with moderate dental caries has a percentage of 7% and the habit of brushing teeth with moderate dental caries has a percentage of 10%. Bad children's brushing habits with high dental caries have a percentage of 11% and 10% for good children's brushing habits with high dental caries. Bad children's brushing habits with very high dental caries have a percentage of 8% and 15% for good children's brushing habits with very high dental caries.

Based on the results of bivariate analysis using Pearson correlation, a significance value of 0.179 ($p>0.05$) was obtained, which means that nutritional status and dental caries have a negative correlation or have an inverse relationship. The results of this study are in line with the research of Zahra *et al* (2020) which showed that there was no relationship between nutritional status and DMF-T in students of SD Negeri 1 Piton. However, the results of this study are not in line with the research of Aulia *et al* (2019) which showed a relationship between BMI/ Age with caries in permanent lower first molars in children aged 6 to 8 years.

The difference between this study and previous studies can be caused by other variables that were not examined in this study. The relationship between BMI and dental caries in children is very complex because it cannot be interpreted in one risk factor alone. There are several things that can affect the results of this study, namely oral hygiene, consumption of sugary drinks, the habit of consuming snacks between main meals, socioeconomic, and genetic aspects (Pinni *et al.*, 2019).

Children with normal nutritional status who experience dental caries are caused by a lack of awareness and knowledge about oral health, such as a lack of understanding of proper brushing techniques, lack of efforts to reduce the consumption of sweet and sticky foods, lack of consumption of fiber and watery foods, and not being diligent in conducting dental examinations at least once every 6 months (Ruyadany *et al.*, 2020).

Changes in composition and increased salivary flow in obese children also lead to a decrease in caries incidence when compared to normal weight children (Ruyadany *et al.*, 2020). This finding is supported by Atzmaryanni & Rizal (2017), literature review, which states that leptin levels in the saliva of obese children tend to be higher compared to children who have normal weight.

The results of the Chi-Square analysis of the relationship between gender and the occurrence of dental caries showed insignificant results. This study is in line with research Pham & Nguyen (2019) dan Kabil & Eltawil (2017), It was found that the prevalence of subjects who experienced dental caries was significantly higher in boys than girls. This may occur because boys appear to be more stubborn and less obedient than girls. Boys usually have more access to sugary foods inside and outside the home. Therefore, the higher prevalence of caries in boys may be due to the high consumption of sugar. (Pham & Nguyen, 2019).

In the Chi-Square test regarding children's food frequency and the occurrence of dental caries, the results did not show significance. This may be due to differences in the method used, especially because the types of foods asked in the method were limited. This method is known as the FFQ method which has closed questions, meaning that only the foods listed were investigated to the subjects. In addition, the FFQ method is semi-qualitative, where subjects who claim to consume certain foods and beverages often do not need to be detailed about the amount or portion consumed. Therefore, using only the FFQ method may cause bias. To reduce this bias, the 24-hour food recall method can also be used. One disadvantage of the FFQ method is its inability to measure the quantity of food consumed and cannot assess the fulfillment of nutritional needs. Errors can also come from the interviewer and respondent, where the interview must be conducted carefully and with enough time so that the information obtained is accurate (Sirajuddin *et al.*, 2018).

When using the Chi-Square test to see the relationship between tooth brushing habits and the occurrence of dental caries, the results also showed no significance. This study is in line with the findings of Elidrissi & Naidoo (2016) who found no association between the experience of dental caries in children with brushing habits and bottle feeding. However, this study is different from the findings of Hasiru *et al* (2019) which showed a relationship between certain actions and dental caries in grade V and VI children of SD Inpres Winangun Kota Manado. This difference can be caused by a lack of understanding of children's knowledge. According to Boustedt *et al* (2020), although mechanical disruption of the oral biofilm is an important event in maintaining oral health, it should be underlined that tooth brushing in the absence of fluoride fails to show benefits in reducing the incidence of dental caries. The results of the study suggest that oral biofilms should be exposed to fluoride ions more than once a day to maximize the effect of caries prevention. Whereas in this study, the researcher only asked about the habits and ways of brushing children's teeth.

In this study, there were several limitations in data collection, such as the lack of children's understanding of some of the questions given, limited time so that researchers were not very careful and became rushed when conducting interviews. In addition, researchers only asked about the frequency of food consumption without knowing the amount of food intake consumed by the research subjects so that there was bias in it regarding whether the amount of food consumption had a significant effect on the incidence of dental caries. This study used an observational research design using a cross-sectional analytic study which means that all variable measurements were taken simultaneously without a follow-up process. Researchers only observe and measure variables without providing interventions. This allows for greater research bias than research with cohort or case control analytic studies.

CONCLUSION

Based on the results of the study, it can be concluded that there is no relationship between nutritional status and the occurrence of caries in elementary school children at

Wonosaren State Elementary School in the age range of 6-12 years. In this study, it was found that for the description of nutritional status in elementary school children at Wonosaren State Elementary School, most of the nutritional status was normal in the age range of 6-12 years and the description of the incidence of dental caries in elementary school children at Wonosaren State Elementary School was found to have the most dental caries with a very low caries value category in the age range of 6-12 years. Suggestions to future researchers are that similar research is needed with cohort analytic studies so that researchers can provide control over the dependent variable observatively to minimize research bias, it is necessary to conduct similar research with more child sample subjects for undernutrition and overnutrition, and further research needs to be done using instruments that can better describe food intake.

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