



# A Study for Dental Caries Risk Factors in Rural School Children in Kediri, Indonesia

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## KEY WORDS

Dental Caries; Risk Factors; Rural School Children; Primary Teeth; Permanent Teeth

## ABSTRACT

Dental caries incidence rate is still increasing. Therefore, research is needed to analyse dental risk factors. This study aimed to analyse dental caries risk factors in Indonesian school children. The study used a cross-sectional design and was conducted between March and April 2023 at SDN Mojo 1 Kediri, with participants in the age group 10-12 years. The questionnaire consisted of four main parts, including personal identity, demographics, oral health knowledge, oral hygiene habits, and the habit of consuming cariogenic foods. The intraoral examination (DMFT and deft index) was conducted after the questionnaire had been completed. The data were analysed using the SPSS software program with descriptive statistics and Spearman's Rho correlation test to determine the bivariate analysis between all variables. Knowledge of oral health, the habit of consuming cariogenic food, and the habit of maintaining oral hygiene were associated with the DMFT and deft index ( $p < 0.05$ ). This study revealed that the risk factors for dental caries in primary and permanent teeth in Indonesian school children, especially in rural areas, are the knowledge of oral health, the habit of consuming cariogenic food, and the habit of maintaining oral hygiene. At the same time, gender was not associated with the caries severity index, both in primary and permanent teeth.

## 1. INTRODUCTION

Dental caries is a complex and multifactorial disease that develops through the interaction of environmental, behavioral, and host factors [1,2]. Host factors, controlled by genetic variations in saliva, as well as environmental influences such as plaque and bacterial accumulation resulting from poor oral hygiene practices, affect the ability of cariogenic bacteria to adhere to tooth surfaces [3]. The time factor acts as a ticking time bomb for the demineralization process of hard tooth tissue. Plaque and food debris left in the mouth for too long and not cleaned promptly will cause dental caries. Tooth brushing habits can also influence the severity of dental caries experienced by an individual [4].

A good quality of life is associated with the experience of dental caries. According to studies, untreated dental caries affects physical and social activities. In school children, it can lead to decreased cognitive activities such as playing, eating, and sleeping, as well as poorer school performance, increased absenteeism, and lower academic achievement [5–7].

Despite significant advances in oral health services over the past few decades, many schoolchildren around the world continue to suffer from various oral disorders such as dental caries [7]. In Indonesia, 57.6% of people have dental caries, according to RISKEDAS 2018 data. The prevalence is 67.3% in children aged 5 to 9 years, 55.6% in those aged 10 to 14 years, and 51.9% in adults aged 15 to 24 years [8]. This prevalence continues to increase each year: in 2007, it was 23.2%, and in 2013, it rose to 25.9% [9].

Children often have weak hand dexterity, lack developmental skills, and have low motivation for oral hygiene, all of which contribute to the high prevalence of dental caries in this group. This is also compounded by the increased availability and consumption of processed carbohydrates and sugar, especially in school settings [5,10]. Identifying individuals and groups at high risk for developing dental caries is crucial for all dental public health efforts worldwide. Recognizing these at-risk populations can help with the prevention and management of dental caries, ultimately reducing its prevalence in school children [10–12]. Elementary School Mojo 1 Kediri is one of the elementary schools under the Indonesian Education Department, located in a rural area near the Public Health Center of Mojo District, Kediri Regency. This study aimed to analyze risk factors for dental caries in Indonesian school children to assist policymakers in evaluating and improving dental and oral health strategies for school-aged children.

## 2. METHODOLOGY

This observational analytical study used a cross-sectional design. A simple random sampling technique was employed to select study subjects who met the inclusion criteria. The inclusion criteria were children aged 10–12 years and free from any known systemic, physical, or mental diseases. The sample size was calculated at a significance level of 0.05, resulting in 66 participants. Ultimately, 67 children were included in the study. The study was conducted between March and April 2023 at an elementary school in Kediri Regency, East Java Province, Indonesia. Prior to beginning the study, permissions from the relevant authorities were obtained, and ethical approval was granted by the Institutional Ethics Committee. Verbal consent was obtained from the study subjects, and written informed consent was collected from parents and school authorities.

The questionnaire consisted of four main parts that had been previously tested for validity and reliability. Question items were considered valid if the calculated *r*-value was greater than the table *r*-value. Reliability, measured using Cronbach's Alpha, was deemed acceptable at a value of 0.60. The first part of the questionnaire collected personal identity and demographic details, such as age, gender, and address. The second part consisted of ten close-ended questions about oral health knowledge, while the third part focused on oral hygiene habits. The fourth part included five close-ended questions about the consumption of cariogenic foods. All participants completed the questionnaire under the supervision of the researcher. The results were categorized as mild, moderate, or severe.

The oral examination was conducted by trained dental professionals after the completion of the questionnaire. Sterilized dental diagnostic kits, including dental mirrors, probes, and excavators, were used. The intraoral examination assessed the severity of dental caries using the decayed, missing, and filled teeth (DMFT) index for permanent teeth, as introduced by Klein, Palmer, and Knutson in 1938 [13], and the deft index for primary teeth. These indices count the total number of decayed (D), missing (M), and filled (F) teeth/surfaces, as well as (e) extracted/exfoliated teeth across the mouth, and are divided into mild, moderate, and severe categories. To ensure data accuracy and reliability, dental professionals used standardized examination instruments and procedures. After the examination, class teachers received a report detailing each child's clinical findings.

The data were managed and analyzed using SPSS software (Statistical Product and Service Solutions) for Windows version 26.0. Descriptive statistics were used to present the distribution of variables. Spearman's Rho correlation test was used for bivariate analysis between gender, oral health knowledge, cariogenic food consumption habits, oral hygiene habits, and DMFT or deft indices. The level of statistical significance was set at 0.05.

## 3. RESULTS

A total number of 67 study subjects (35 males and 22 females) were enrolled in this cross-sectional study. The characteristics of study subjects are shown in Table 1.

Characteristics	Number	Percentage (%)
<b>Age</b>		
10	30	44,8
11	32	47,8
12	5	7,4
<b>Gender</b>		
Female	32	47,8
Male	35	52,2

Table 1. The characteristics of study subjects

In the univariate analysis presented in Table 2, most of the study subjects had mild knowledge of oral health (76.1%), and mild habits of consuming cariogenic foods (82.1%). Around 46.3% and 32.8% of the children maintained oral hygiene are in the severe and mild categories, respectively. Both DMFT (59.7%) and deft (50.7%) indexes showed that the study subjects had a severe caries severity index.

The results of the bivariate analysis between gender, knowledge of oral health, the habit of consuming cariogenic food, the habit of maintaining oral hygiene, and DMFT or deft index are presented in Table 3. Knowledge of oral health, the habit of consuming cariogenic food, and the habit of maintaining oral hygiene were associated with DMFT and deft indexes ( $p < 0.05$ ).

The correlation coefficient between knowledge and both DMFT and deft indexes showed positive values. The same was observed for the correlation coefficient between the habit of consuming cariogenic food and the DMFT index, while its association with the deft index variable showed the opposite, a negative value. Negative values were also found in the correlation

coefficient between the habit of maintaining oral hygiene and both DMFT and deft indexes, as well as between the habit of consuming cariogenic food and the deft index.

<b>Classification</b>	<b>Number</b>	<b>Percentage (%)</b>
<b>Knowledge</b>		
Severe	10	14,9
Moderate	6	9,0
Mild	51	76,1
<b>The Habit of Consuming Cariogenic Food</b>		
Severe	7	10,4
Moderate	5	7,5
Mild	55	82,1
<b>The Habit of Maintaining Oral Hygiene</b>		
Severe	31	46,3
Moderate	14	20,9
Mild	22	32,8
<b>DMFT Index</b>		
Severe	12	17,9
Moderate	15	22,4
Mild	40	59,7
<b>deft Index</b>		
Severe	15	22,4
Moderate	18	26,9
Mild	34	50,7

Table 2. Univariate Analysis between the study subjects regarding knowledge, habits, DMFT and deft Index.

		<b>DMFT</b>	<b>deft</b>
<b>Knowledge</b>	Correlation Coefficient	.255*	.245*
	Sig. (2-tailed)	.038	.046
	N	67	67
<b>Cariogenic food</b>	Correlation Coefficient	.257*	-.302*
	Sig. (2-tailed)	.036	.013
	N	67	67
<b>Oral hygiene</b>	Correlation Coefficient	-.249*	-.250*
	Sig. (2-tailed)	.042	.041
	N	67	67
<b>Gender</b>	Correlation Coefficient	.160	.111
	Sig. (2-tailed)	.197	.373
	N	67	67

Table 3 Bivariate analysis between gender, knowledge of oral health, the habit of consuming cariogenic food, the habit of maintaining oral hygiene, DMFT, and deft. \* = Correlation is significant at the 0.05 level (2-tailed), N = Number of observations

#### 4. DISCUSSION

The present study analyzed the dental caries risk factors in rural school children at an elementary school in Mojo 1, Kediri Regency, East Java Province, Indonesia, aged 10–12 years. This study found that knowledge of oral health, the habit of consuming cariogenic food, and the habit of maintaining oral hygiene were associated with the caries severity index, indicating that these are risk factors for dental caries in both primary and permanent teeth. These risk factors differ between urban and rural areas. Rural areas are often characterized by child poverty, unemployment, low education, and fewer health care providers, such as the availability of dentists, which are social determinants of oral health. This contrasts with urban areas. This study also found a high prevalence of dental caries among the study subjects. This aligns with previous research indicating that the severity index of caries is higher in rural areas than in urban areas [14]. The caries severity index showed that 59.7% and 50.7% of study subjects experienced severe dental caries in their permanent and primary teeth, respectively. This result is consistent with published evidence reporting the prevalence of dental caries among Indonesian children aged 10 to 14 years is 55.6% [8].

In this study, gender was not associated with the caries severity index in either primary or permanent teeth. Current studies have reported inconsistent relationships between gender and the caries severity index [15–18]. Some studies did not find a statistically significant relationship between gender and the DMFT rate [19,20], while others found that the DMFT rate in girls was significantly higher than in boys [20,21]. In contrast, a study from [22] found that boys are more likely to experience caries lesions than girls. Several global studies on gender disparities in oral health have identified connections with a wide range of variables, including behavioral traits, social and cultural distinctions, gender-based dietary preferences, physiological components such as saliva flow and composition, and hormonal determinants [21,23].

The bivariate analysis results between knowledge of oral health and both the DMFT and deft indices, and between the habit of consuming cariogenic food and the DMFT index, showed a positive value. This means that children with poor dental knowledge or frequent consumption of cariogenic food are associated with a more severe caries severity index. There is evidence that the age at which cariogenic foods like sugar are introduced and the frequency of sugar consumption are factors that appear to augment the influence of dietary behaviors on the trajectory of caries occurrence. Cariogenic food consumption during the first year of life is linked to dental caries in later years, according to cohort studies. Research conducted on various populations has demonstrated the association between caries incidence and frequent sugar consumption. Daily sugar consumption can increase saliva acidity and correlate with the level of dental caries [21,24]. Meanwhile, the bivariate analysis results between the habit of consuming cariogenic food and the deft index showed a negative value. This suggests that children with frequent consumption of cariogenic food are associated with a milder caries severity index. This is because the age range of the study subjects in this research is 10–12 years, during which many primary teeth have already fallen out and been replaced with permanent teeth.

The habit of maintaining oral hygiene was still associated with a severe caries severity index (both DMFT and deft indices). This finding is consistent with previous studies showing that dental knowledge [21,25,26] and the habit of maintaining oral

hygiene [10,15,27,28] are main risk factors for severe dental caries in children. Previous systematic reviews have explained that oral health knowledge is a major risk factor for oral diseases, including dental caries [21]. Knowledge, attitude, and behavior—which are components of health behavior—impact oral health [29,30]. A child's oral health condition is related to their oral hygiene, which is influenced by tooth brushing and snacking habits [27]. However, studies have shown that most elementary school-age children still struggle with the correct brushing technique. This highlights the need for parents to ensure that children are receiving proper guidance and education on dental hygiene [30,31]. Tooth and oral cavity health are significantly influenced by oral hygiene. Dental caries risk can be decreased by practicing good oral hygiene [15,28].

This study has certain limitations, and it is important to interpret the results carefully. The prevalence of dental caries of permanent and primary teeth revealed in this study is age-specific, since the respondents were 10–12 years old and had fewer permanent and primary teeth than older or younger children. It is important to be cautious when interpreting the DMFT and deft status results and applying them to children of all ages, as the analysis is based on a cross-sectional design, which means that the results cannot be used to determine causal relationships. To better understand the factors that contribute to caries risk in Indonesian school children, it is recommended to use a longitudinal design.

## 5. CONCLUSION

The study identified knowledge of oral health, the habit of consuming cariogenic foods, and oral hygiene habits as risk factors for dental caries in both primary and permanent teeth among Indonesian school children, particularly those in rural areas of Kediri. Gender was not found to be associated with the caries severity index in either primary or permanent teeth. Children with limited dental knowledge or frequent intake of cariogenic foods exhibited higher caries severity indices. Similarly, inadequate oral hygiene habits correlated with increased severity in both DMFT and deft indices. Further longitudinal research is recommended to investigate caries risk factors in Indonesian school children.

## Conflict of Interest

The authors declare no conflicts of interest in this study.

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Not applicable.

## Authors Contribution

MK and AR: Conceptualization, Methodology, Formal Analysis, Data Curation. MK: Original Draft Writing, Editing, and Administration.

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