Dental Journal
Majalah Kedokteran Gigi

Dental Journal
(Majalah Kedokteran Gigi)
2025 September; 58(3): 280–288

Original article

Dental caries risk factors in West Jakarta Primary students: A cross-sectional study

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ABSTRACT

Background: *The majority of children in Indonesia, particularly in Jakarta, continue to experience numerous dental and oral health issues, with dental caries being especially prevalent. Caries is a multifactorial disease that, in children, can be caused by personal habits or external influences.* ***Purpose:*** *This study aimed to determine the relationship between caries risk factors and the occurrence of caries in primary school children in West Jakarta, Indonesia.* ***Methods:*** *The study was conducted in three public primary schools in West Jakarta in November 2023. Oral examinations and questionnaires were completed by all students from fourth to sixth grade, with a total sample size of 421 students. In this study, caries was the dependent variable, and the independent variables included sociodemographic factors, oral health behaviors, smoking habits, and dietary habits. Data analysis involved bivariate analysis and the application of a multivariate prediction model using logistic regression.* ***Results:*** *The variables significantly associated with dental caries were never visiting the dentist ($p < 0.05$), brushing teeth never or only several times a week ($p < 0.05$), never consuming fruits ($p < 0.05$), and consuming biscuits several times a day ($p < 0.05$). However, other variables—such as parental education, use of oral cleaning tools and fluoride toothpaste, smoking habits, and consumption of certain sweet foods and beverages—did not show a significant association.* ***Conclusion:*** *The most substantial factors contributing to dental caries were infrequent toothbrushing and frequent consumption of biscuits. Interestingly, children who never visited the dentist had lower incidences of caries.*

Keywords: *biscuits; children; dental caries; toothbrushing*
Article history: *Received 28 March 2024; Revised 8 June 2024; Accepted 2 July 2024; Online 28 May 2025*

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INTRODUCTION

Caries is one of the most common and serious health problems in the oral cavity. Caries in children is a serious issue, as it increases the risk of tooth loss in adulthood. Therefore, children with dental caries require immediate treatment to preserve their quality of life.[1] In Indonesia, the majority of children still have poor oral health, and many do not receive dental treatment until they reach adolescence or even adulthood. About 70% of these problems are related to dental caries.[2] According to a 2018 survey by the Ministry of Health of the Republic of Indonesia, 92.6% of children aged 5–9 years and 73.4% of children aged 10–14 years have dental caries. This reflects a relatively high prevalence.[3] It is also known that in Jakarta, the prevalence of caries in children aged 12 reached 84%, with an average DMF-T score of 3.2.[4]

Caries is a multifactorial disease that is difficult to avoid due to its complex interactions. It is primarily caused by four factors: the host (teeth), substrate (fermentable carbohydrates), microorganisms, and time. In addition, there are aspects known as caries risk factors that do not directly cause caries but are strongly associated with its development.[5] Sociodemographic background, frequency of toothbrushing, diet, and dental visits are several risk factors linked to the development of dental caries in children.[6]

Previous research has shown that caries, particularly in children, can result from a variety of factors, including the child's own habits and external influences such as parents or the environment.[7,8] It is widely acknowledged that many

DOI: 10.20473/j.djmkg.v58.i3.p280–288

children have a preference for sweets and sugary drinks, despite the fact that sugar is a substantial contributor to dental caries. Some studies show that children who consume sugar more frequently have higher rates of dental caries.[9,10] Moreover, previous studies have also shown that the sex and age of a child are associated with the occurrence of caries. This is likely due to cultural and social differences between boys and girls, and because a child's awareness increases with age.[9,11]

Parents play a substantial role in the occurrence of caries in children. Numerous studies have examined the correlation between parents' educational levels and their children's caries rates, whether referring to the father or the mother. Parents with a higher level of education typically possess more knowledge about maintaining their child's oral hygiene.[2,12] Similarly, not all parents regularly take their children to the dentist, although routine visits have a positive impact and can prevent early caries.[13]

Moreover, children should develop the habit of brushing their teeth twice a day using the proper technique and frequency, with fluoride toothpaste and an appropriate toothbrush. These factors are crucial, as previous studies have demonstrated a significant correlation between high caries scores (DMF-T and DMF-S) and irregular toothbrushing, as well as the absence of a toothbrush or fluoride toothpaste.[2,13,14]

Therefore, with an understanding of the many factors linked to childhood caries and the persistently high rates of caries in Jakarta, researchers conducted this study to determine the relationship between caries risk factors and the occurrence of caries in primary school children in West Jakarta, Indonesia.

MATERIALS AND METHODS

The cross-sectional study was conducted in West Jakarta in November 2023. Participants in this study consisted of primary school students aged 8–14 from the School-Based Dental Program, selected from three public primary schools located in the West Jakarta region. The total sample included 421 students. Schools were selected using convenience sampling. Ethical clearance was obtained from the Ethical Review Committee (No. 032/S3/KEPK/FKG/7/2023).

Oral exams and questionnaire completion were the methods used to collect data. Oral examinations and questionnaires were conducted with all students from fourth to sixth grade, and each parent and child was informed about the study and asked to complete the informed consent form. The oral examination for caries was carried out by five undertrained dentists using the World Oral Health (WHO) dental caries diagnosis guideline index (available at www.who.int). The examinations were conducted in classrooms using a dental mirror, probe, and headlamp. All instruments were disinfected with an antiseptic solution after each use. The results of the caries examination, based on the WHO index, yielded the deft or DMFT score. Prior to the study, data collectors received intensive training on dental caries assessment based on the WHO guidelines, as well as on how to interview the children and complete the questionnaire. The questionnaire included questions about sociodemographic characteristics (age, gender, and education level of both parents), oral health behavior (frequency of dental visits, toothbrushing frequency, use of oral cleaning tools, and smoking habits), and dietary habits (frequency of consuming sweet foods and beverages).

In this study, the dependent variable is caries. Caries is categorized into two groups: "no," indicated by a decayed tooth score (D) = 0, and "yes," indicated by a decayed tooth score (D) ≥ 1. Dental caries was defined as the presence of a lesion in a pit or fissure or on a smooth tooth surface, with a detectable softened floor, undermined enamel, or softened wall. When any doubt existed, dental caries was not recorded as present. A tooth was considered missing due to caries if the individual reported a history of pain and/or the presence of a cavity before extraction.

The independent variables include oral health behavior, smoking habits, and consumption habits. Potential confounders in this study are sociodemographic factors, including age, gender, father's education, and mother's education. Parents' education is categorized into four groups: low (not attending school, not completing primary school, graduating from primary school, or graduating from junior high school), middle (graduating from senior high school), high (holding a college diploma or bachelor's degree), and unknown (no adults in the household or uncertain response). Oral health behavior includes the frequency of dental visits, frequency of toothbrushing, and use of toothpicks, dental floss, charcoal, siwak, and fluoride. The frequency of dental visits is categorized into three groups: rarely (only once or twice in the last 12 months), sometimes (three or more times in the last 12 months), and never (not having visited a dentist in the last 12 months or unsure). The frequency of toothbrushing is categorized into three groups: never or several times a week, once a day, and two or more times a day. The use of oral cleaning tools is categorized as either yes or no. Smoking habit is also categorized as either yes or no. Consumption habits include the frequency of consuming fruits, biscuits, soda, honey or jam, gum, candy, sweetened milk, sweet tea, and sweet coffee. Each item is categorized into three groups: never, several times a week, and several times a day.

Data were entered and analyzed using the Statistical Package for the Social Sciences, version 26. Descriptive analysis was applied to observe the distribution of variables, and the results are presented in tabular form. Data analysis included both bivariate and multivariate approaches. Bivariate analysis was used to determine the relationship between the dependent variable and each independent variable. A multivariate prediction model was developed using logistic regression. Any substantial effects of confounding variables were adjusted for in the multivariate analysis.

DOI: 10.20473/j.djmkg.v58.i3.p280–288

RESULTS

Data were collected from 421 respondents for this study. The dependent variable was the incidence of caries among elementary school students enrolled in the School-Based Dental Program in West Jakarta. In this study, 87.9% (n = 370) of the children were diagnosed with caries. Respondent characteristics are shown in Table 1. The average age of respondents was 11.15 years. Most of the respondents were male (56.3%). Regarding parental educational background, the majority of respondents had unknown information about both the father's education (41.8%) and the mother's education (37.8%).

More than half of the study population had never visited a dentist (52.7%). Most respondents reported brushing their teeth two or more times a day (57.7%). Additionally, more than half of the respondents did not use toothpicks (82.4%), dental floss (92.9%), charcoal (99.3%), or siwak (90.3%), but did use fluoridated toothpaste (54.6%). The majority of the population reported never having smoked (96.2%).

In terms of consumption patterns, most of the study population consumed fruits, biscuits, sweetened milk, and sweet tea several times a day. Most respondents never consumed the other listed foods and beverages.

In general, there was no significant correlation between the incidence of dental caries and the educational levels of either the father or the mother (Table 2).

Respondents who never visited the dentist had 79% lower odds of experiencing caries than those who frequently visited the dentist (95% confidence interval [CI]: 0.05–0.92,

Table 1. Distribution and frequency of variables among all respondents

Variables	n (%) / mean (S.D)	Variables	n (%) / mean (S.D)
		Fluoride usage	
Age (years)	11.15 (0.95)	Yes	230 (54.6)
		No	191 (45.4)
Sex		Smoking habits	
Male	237 (56.3)	No	405 (96.2)
Female	184 (43.7)	Yes	16 (3.8)
Father's education		Fruits consumption frequency	
Low	76 (18.1)	Never	76 (18.1)
Middle	132 (31.4)	Several times a week	129 (30.6)
High	37 (8.8)	Several times a day	216 (51.3)
Unknown	176 (41.8)		
Mother's education		Biscuit consumption frequency	
Low	90 (21.4)	Never	84 (20)
Middle	120 (28.5)	Several times a week	142 (33.7)
High	52 (12.4)	Several times a day	195 (46.3)
Unknown	159 (37.8)		
Dental caries		Soda consumption frequency	
No	51 (12.1)	Never	283 (67.2)
Yes	370 (87.9)	Several times a week	86 (20.4)
		Several times a day	52 (12.4)
Dental visits		Honey/jam consumption frequency	
Rarely	147 (34.9)	Never	215 (51.1)
Sometimes	52 (12.4)	Several times a week	116 (27.6)
Never	222 (52.7)	Several times a day	90 (21.4)
Toothbrushing frequency		Gum consumption frequency	
Never/several times a week	136 (32.3)	Never	167 (39.7)
Once a day	42 (10)	Several times a week	136 (32.3)
Two or more times in a day	243 (57.7)	Several times a day	118 (28)
Toothpick user		Candy consumption frequency	
Yes	74 (17.6)	Never	167 (39.7)
No	347 (82.4)	Several times a week	136 (32.3)
		Several times a day	118 (28)
Dental floss user		Sweet milk consumption frequency	
Yes	30 (7.1)	Never	72 (17.1)
No	391 (92.9)	Several times a week	127 (30.2)
		Several times a day	222 (52.7)
Charcoal user		Sweet tea consumption frequency	
Yes	3 (0.7)	Never	97 (23)
No	418 (99.3)	Several times a week	135 (32.1)
		Several times a day	189 (44.9)
Siwak user		Sweet coffee consumption frequency	
Yes	41 (9.7)	Never	295 (70.1)
No	380 (90.3)	Several times a week	71 (16.9)
		Several times a day	55 (13.1)

DOI: 10.20473/j.djmkg.v58.i3.p280–288

p = 0.038). The proportion of respondents who never or only occasionally brushed their teeth and experienced caries (34.3%) was higher than that of respondents without caries (17.6%), and this difference was statistically significant (p = 0.013). An odds ratio (OR) of 2.62 (95% CI: 1.22–5.59) indicates that respondents who never or only occasionally brushed their teeth had 2.62 times higher odds of experiencing caries than those who brushed their teeth two or more times a day. There was no significant relationship between the occurrence of dental caries and the use of toothpicks, dental floss, charcoal, siwak, or fluoride toothpaste (Table 3).

The proportion of respondents who did not consume fruits and experienced caries was lower (16.8%) than that of respondents who did not experience caries (27.5%), and this difference was statistically significant (p = 0.026). The OR value of 0.427 (95% CI: 0.2–0.9) indicates that respondents who never consume fruits have 57% lower odds of experiencing caries compared to those who consume fruits several times a day.

The proportion of respondents who consumed biscuits several times a day and experienced caries was higher (48.9%) than that of respondents who did not experience caries (27.5%), and this difference was statistically significant (p = 0.019). The OR of 2.59 (95% CI: 1.17–5.7) suggests that respondents who consumed biscuits several times a day had 2.59 times higher odds of experiencing caries.

There was no significant relationship between the occurrence of dental caries and smoking habits or the

Table 2. Association between parents' education levels and dental caries incidence

Variables	Dental Caries		OR (95% CI)	p-value
	No n (%)	Yes n (%)		
Father's education				
Low	5 (9.8)	71 (19.2)	2.22 (0.6–8.21)	0.232
Middle	18 (35.3)	114 (30.8)	0.99 (0.34–2.87)	0.985
High	5 (9.8)	32 (8.6)	1 (reference)	
Unknown	23 (45.1)	153 (41.4)	1.04 (0.37–2.94)	0.942
Mother's education				
Low	6 (11.8)	84 (22.7)	2.18 (0.69–6.87)	0.184
Middle	23 (45.1)	97 (26.2)	0.66 (0.26–1.64)	0.368
High	7 (13.7)	45 (12.2)	1 (reference)	
Unknown	15 (29.4)	144 (38.9)	1.49 (0.57–3.89)	0.412

*p-value < 0.05; Bivariate analysis used logistic regression test and chi-square or Fisher's exact test

Table 3. Relationship between oral health behavior and the incidence of dental caries

Variables	Dental Caries		OR (95% CI)	p-value
	No n (%)	Yes n (%)		
Dental visit				
Rarely	14 (27.5)	133 (35.9)	0.38 (0.08–1.73)	0.211
Sometimes	2 (3.9)	50 (13.5)	1 (reference)	
Never*	35 (68.6)	187 (50.5)	0.21 (0.05–0.92)	0.038
Toothbrushing frequency				
Never/several times a week*	9 (17.6)	127 (34.3)	2.62 (1.22–5.59)	0.013
Once a day	4 (7.8)	38 (10.3)	1.76 (0.59–5.22)	0.308
Two or more times in a day	38 (74.5)	205 (55.4)	1 (reference)	
Toothpick user				
Yes	14 (27.5)	60 (16.2)	0.51 (0.26–1)	0.051
No	37 (72.5)	310 (83.8)	1 (reference)	
Dental floss user				
Yes	2 (3.9)	28 (7.6)	1 (reference)	
No	49 (96.1)	342 (92.4)	0.5 (0.12–2.16)	0.352
Charcoal user				
Yes	1 (2)	2 (0.5)	1 (reference)	
No	50 (98)	368 (99.5)	3.68 (0.33–41.33)	0.291
Siwak user				
Yes	8 (15.7)	33 (8.9)	1 (reference)	
No	43 (84.3)	337 (91.1)	1.9 (0.82–4.38)	0.132
Fluoride usage				
Yes	24 (47.1)	206 (55.7)	1 (reference)	
No	27 (52.9)	164 (44.3)	0.71 (0.39–1.27)	0.248

*p-value < 0.05; Bivariate analysis used logistic regression test and chi-square or Fisher's exact test

DOI: 10.20473/j.djmkg.v58.i3.p280–288

consumption of soda, honey/jam, chewing gum, candy, sweet milk, sweet tea, or sweet coffee (Table 4).

Variables with a *p*-value < 0.25 in the bivariate analysis and/or those considered to have a clinically significant effect on the occurrence of caries were included in the multivariate logistic regression model. These variables include frequency of dental visits, frequency of toothbrushing, use of toothpicks, use of siwak, use of fluoridated toothpaste, fruit consumption, biscuit consumption, honey/jam consumption, father's education, and mother's education (Table 5).

Table 6 represents the conclusive stage of the logistic regression analysis, serving as the final model for the multivariate analysis. The results indicated that, among all the independent variables considered to influence the incidence of caries in respondents, the most relevant factors were brushing frequency (never/several times a week), use of toothpicks, and consuming biscuits several times a day. Compared with respondents who brushed their teeth two or more times a day, those who brushed never or only several times a week had 2.15 times higher odds of experiencing caries (β = 0.92, 95% CI = 1.16–5.47, SE = 0.396), and this finding was statistically significant (p = 0.02).

In addition, the use of toothpicks was also associated with the incidence of caries (p = 0.043). An AOR value below 1 indicates that respondents who used toothpicks had lower odds of experiencing caries (β = –0.72, 95% CI = 0.24–0.98, SE = 0.357).

Respondents who consumed biscuits several times a day had 2.91 times higher odds of experiencing caries compared

Table 4. Relationship between smoking habits, consumption habits, and the incidence of dental caries

Variables	Dental Caries		OR (95% CI)	p-value
	No n (%)	Yes n (%)		
Smoking habits				
No	51 (100)	354 (95.7)	1 (reference)	
Yes	0	16 (4.3)	232737901.1 (0.0–∞)	0.998
Fruits consumption frequency				
Never*	14 (27.5)	62 (16.8)	0.427 (0.2-0.9)	0.026
Several times a week	18 (35.3)	111 (30)	0.6 (0.3–1.18)	0.137
Several times a day	19 (37.3)	197 (53.2)	1 (reference)	
Biscuit consumption frequency				
Never	14 (27.5)	70 (18.9)	1 (reference)	
Several times a week	23 (45.1)	119 (32.2)	1.04 (0.5–2.14)	0.927
Several times a day*	14 (27.5)	181 (48.9)	2.59 (1.17–5.7)	0.019
Soda consumption frequency				
Never	38 (74.5)	245 (66.2)	1 (reference)	
Several times a week	9 (17.6)	77 (20.8)	1.33 (0.61–2.87)	0.472
Several times a day	4 (7.8)	48 (13)	1.86 (0.64–5.46)	0.258
Honey/ jam consumption frequency				
Never	34 (66.7)	181 (48.9)	1 (reference)	
Several times a week	10 (19.6)	106 (28.6)	1.99 (0.95–4.19)	0.07
Several times a day	7 (13.7)	83 (22.4)	2.23 (0.95–5.23)	0.066
Gum consumption frequency				
Never	27 (52.9)	185 (50)	1 (reference)	
Several times a week	15 (29.4)	104 (28.1)	1.01 (0.52–1.99)	0.973
Several times a day	9 (17.6)	81 (21.9)	1.31 (0.59–2.92)	0.503
Candy consumption frequency				
Never	22 (43.1)	145 (39.2)	1 (reference)	
Several times a week	15 (29.4)	121 (32.7)	1.22 (0.61–2.46)	0.571
Several times a day	14 (27.5)	104 (28.1)	1.13 (0.55–2.31)	0.743
Sweet milk consumption frequency				
Never	11 (21.6)	61 (16.5)	1 (reference)	
Several times a week	13 (25.5)	114 (30.8)	1.58 (0.67–3.74)	0.297
Several times a day	27 (52.9)	195 (52.7)	1.3 (0.61–2.78)	0.494
Sweet tea consumption frequency				
Never	12 (23.5)	85 (23)	1 (reference)	
Several times a week	18 (35.3)	117 (31.6)	0.92 (0.42–2)	0.829
Several times a day	21 (41.2)	168 (45.4)	1.13 (0.53–2.41)	0.752
Sweet coffee consumption frequency				
Never	37 (72.5)	258 (69.7)	1 (reference)	
Several times a week	8 (15.7)	63 (17)	1.13 (0.5–2.55)	0.769
Several times a day	6 (11.8)	49 (13.2)	1.17 (0.47–2.92)	0.735

*p-value < 0.05; Bivariate analysis used logistic regression test and chi-square or Fisher's exact test

DOI: 10.20473/j.djmkg.v58.i3.p280–288

Table 5. Multivariate logistic regression modeling to predict factors associated with dental caries

Variables	Model 1		Model 2		Model 3		Model 4	
	AOR	p	AOR	p	AOR	p	AOR	p
Dental visit								
Rarely	0.66	0.603	0.58	0.495	0.48	0.351		
Sometimes	1		1		1			
Never	0.35	0.171	0.31	0.129	0.27	0.084		
Toothbrushing frequency								
Never/several times a week*	2.36	0.044	2.15	0.063	2.15	0.058	2.15	0.02
Once a day	2.16	0.21	1.73	0.353	1.80	0.308	1.49	0.482
Two or more times in a day	1		1		1		1	
Toothpick user								
Yes	0.64	0.265	0.61	0.208	0.62	0.205	0.49	0.043
No	1		1		1		1	
Siwak user								
Yes	1		1		1			
No	1.56	0.365	1.6	0.326	1.65	0.278		
Fluoride user								
Yes	1		1		1			
No	0.75	0.391	0.75	0.382	0.67	0.209		
Biscuit consumption frequency								
Never	1		1		1		1	
Several times a week	1.38	0.457	1.43	0.384	1.37	0.419	1.28	0.517
Several times a day	2.99	0.016	2.995	0.011	3.13	0.007	2.91	0.01
Fruits consumption frequency								
Never*	0.58	0.215	0.49	0.089				
Several times a week	0.71	0.366	0.68	0.306				
Several times a day	1		1					
Mother education								
Low	1.77	0.407	2.66	0.114				
Middle	0.56	0.32	0.83	0.708				
High	1		1					
Unknown	3.61	0.045	2.08	0.161				
Honey consumption frequency								
Never	1							
Several times a week	1.5	0.331						
Several times a day	1.13	0.799						
Father education								
Low	1.89	0.411						
Middle	1.55	0.501						
High	1							
Unknown	0.47	0.275						

Multivariate analysis uses a logistic regression test.

Table 6. Final model of predictive factors associated with dental caries

Variabel	AOR	95% CI	p	Koefisien b	S.E.
Toothbrushing frequency					
Never/several times a week*	2.15	1.16–5.47	0.02	0.92	0.396
Once a day	1.49	0.49–4.53	0.482	0.39	0.568
Two or more times in a day	1				
Toothpick user					
Yes*	0.49	0.24–0.98	0.043	-0.72	0.357
No	1				
Biscuit consumption frequency					c
Never	1				
Several times a week	1.28	0.61–2.72	0.517	0.25	
Several times a day*	2.91	1.3–6.54	0.01	1.07	

Multivariate analysis uses a logistic regression test.

DOI: 10.20473/j.djmkg.v58.i3.p280–288

to those who never consumed biscuits (β = 1.07, 95% CI = 1.30–6.54, SE = 0.413), and this finding was statistically significant (p = 0.01).

Other variables, such as frequency of dental visits, use of siwak, use of fluoride toothpaste, fruit consumption, honey/jam consumption, father's education, and mother's education, were not significantly associated with the incidence of caries in the multivariate analysis.

DISCUSSION

In this study, the dental and oral hygiene behavior of respondents is quite good (Table 1). The majority of respondents brush their teeth at the right time, do not use toothpicks, dental floss, or charcoal, and use fluoride toothpaste. However, the prevalence of caries in this study is quite high, at 87.9%, even higher than that reported in Jakarta in 2018 (61%)[15] and 2021 (71%).[6] Although oral hygiene behavior appears to be good, most respondents consume sweet foods and beverages (such as biscuits, sweet milk, and sweet tea) several times a day. This is in line with research in India, which showed that respondents with caries had a significantly 1.8 times higher sugar exposure than those without caries.[16]

The results of Gorgi et al.'s study show a significant direct relationship, where an increase in a mother's education is associated with a higher likelihood of children being caries-free.[17] Similar findings were reported in research by Dumitrescu et al., which demonstrated a significant relationship between children's DMFT scores and their parents' educational levels.[18] However, the present study shows no significant relationship between the educational levels of fathers or mothers and the occurrence of dental caries in children (Table 2). Previous studies have also reported no significant association between maternal[19] or paternal[20] education and dental caries.

In this study, the frequency of visits to the dentist is significantly associated with dental caries (Table 3). Respondents who never visited the dentist had 79% lower odds of experiencing caries than those who frequently visited the dentist (95% CI: 0.05–0.92, p = 0.038). Similar findings have shown a significant association between dental caries and dental visit history.[21,22] However, this contradicts research conducted in Surabaya, which found that respondents who had never visited a dentist had a 1.3 times higher risk of caries than those who had.[2] These findings suggest that caries etiology is multifactorial, requiring further investigation of other contributing factors.

The present study also shows that the proportion of respondents who never or only several times a week brushed their teeth and experienced caries (34.3%) was higher than that of respondents who did not experience caries (17.6%), and this difference was statistically significant (p = 0.013). The OR value of 2.62 (95% CI: 1.22–5.59) indicates that respondents who never or rarely brushed their teeth had 2.62 times higher odds of experiencing caries than those who brushed their teeth two or more times a day. Similar findings have reported a significant association between the frequency of toothbrushing and dental caries. Children who do not or rarely brush their teeth experience a higher incidence of dental caries compared to those who brush their teeth with the recommended frequency.[23,24] Brushing with a toothbrush is more effective in removing plaque from the tooth surface because the bristles can reach areas of the oral cavity that are not accessible to the finger or other materials. Regular brushing helps remove food debris from the oral cavity, limiting the nutrients and time available for *S. mutans* to grow. As a result, acid production is reduced, preventing the development of dental caries.[2,25,26]

Sugar, or sucrose, is considered a crucial dietary component and an etiological factor in the development of dental caries. Sucrose consumed at high frequency supports the growth of *Streptococcus mutans* and is considered a caries-promoting dietary substance. The specific amount and type of sugar consumed are important, as dietary frequency and pattern are substantial predictors of an individual's caries activity.[10] In this study, there is a significant association between respondents who never consume fresh fruit and those who consume biscuits several times a day with the incidence of dental caries (Table 4). Respondents who never consume fresh fruit have 57% lower odds of experiencing caries compared to those who consume fresh fruit several times a day, while those who consume biscuits several times a day have 2.59 times higher odds of experiencing caries.

Studies conducted by Sim et al.[27] and Kaye et al.[28] reported different findings, indicating that individuals who consumed fruit had lower caries scores than those who never consumed fruit. Fruit intake may have a protective effect on dental caries, as fruits are rich in polyphenols and isothiocyanates, which possess antimicrobial properties that can potentially prevent dental caries.[27]

Multivariate analysis showed that, among all the independent variables thought to influence the incidence of caries in respondents, the variables most strongly associated with caries were brushing never or several times a week, use of toothpicks, and consumption of biscuits several times a day (Table 6). Toothbrushing has long been recognized as an effective method for preventing tooth decay. It removes food particles and bacteria from the mouth, thereby reducing the risk of caries. Ideally, brushing should be done right after meals. If this is not possible, it is recommended to brush twice daily—once in the morning and once before bedtime. Numerous studies have shown that brushing teeth twice a day has a preventive effect against caries compared to brushing less frequently.[29] Therefore, encouraging children to brush twice daily may help prevent the growth of bacterial colonies and the advancement of plaque into calculus, which is a major contributing factor to dental caries. Brushing teeth in the evening or just before bedtime reduces the damage bacteria can cause, as less saliva is secreted during sleep, and the mouth's defense against

DOI: 10.20473/j.djmkg.v58.i3.p280–288

plaque and bacteria decreases. Dental cavities may result from this condition.[30] These findings are supported by other studies that also show caries are associated with the habit of never or rarely brushing teeth.[31,32]

Based on previous studies, the relationship between the use of toothpicks and dental caries has not been well established. While a study among urban primary school children in Ethiopia reported that 67.6% of children cleaned their teeth using traditional toothpicks, which was associated with dental caries,[33] another study did not show a substantial positive or negative effect of using toothpicks for plaque control.[34] Instead, the use of toothpicks appears to be more closely related to gingival health status. Research conducted in Southeast Sulawesi and Aceh found a significant relationship between gingival health and the use of toothpicks, highlighting the importance of proper toothpick use.[35,36] In this study, respondents were not assessed for gingival health status.

Dietary sugar exposure can influence the microbial composition and increase the levels of cariogenic bacteria, leading to dental caries. This occurs due to high acid production by microorganisms such as bacteria on the teeth, caused by the fermentation of sweet foods. Gradually, the enamel of the tooth demineralizes, resulting in dental caries.[37,38] Biscuits are considered a type of cariogenic food due to their high sugar content. However, the cariogenic properties of biscuits can vary from low to moderate.[39,40] Based on Almasi et al.'s research, the odds of being in the caries-prone subgroup of children who consumed sweet biscuits more than once daily were 1.51 times higher than those of children who consumed them less than three times a week or never.[41] Previous studies have reported similar findings, indicating a significant association between dental caries and the consumption of biscuits several times a day.[42,43]

Limitations of this study include the fact that data collection was carried out by undertrained dentists, and interobserver bias could not be entirely avoided. Additionally, the generalizability of the findings may be limited to children with similar demographic and school characteristics as the study population (school-aged children aged 8–14 years living in West Jakarta).

This study aimed to identify the key risk factors contributing to dental caries among primary school students in West Jakarta, a region where oral health issues remain prevalent among children. The findings revealed that infrequent toothbrushing and high biscuit consumption were substantial predictors of dental caries in this population. Interestingly, children who never visited the dentist had lower incidences of caries, suggesting potential underreporting or disparities in access to dental care.

These results underscore the need for targeted public health interventions focused on improving daily oral hygiene practices and dietary habits among schoolchildren. Additionally, the unexpected findings regarding dental visits warrant further investigation to better understand barriers to professional dental care in urban Indonesian settings. Future research should explore the underlying reasons why students who do not visit dentists show lower caries rates, possibly examining socioeconomic factors and healthcare accessibility. A longitudinal study could also help assess the long-term impacts of early dietary habits on oral health.

By identifying critical risk factors for dental caries among children in West Jakarta, this study contributes to the global understanding of pediatric oral health and provides a foundation for the development of more effective dental health policies and educational programs.

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DOI: 10.20473/j.djmkg.v58.i3.p280–288