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Risk Factors Dental Caries Based on Disease Indicator CAMBRA in Preschool Children

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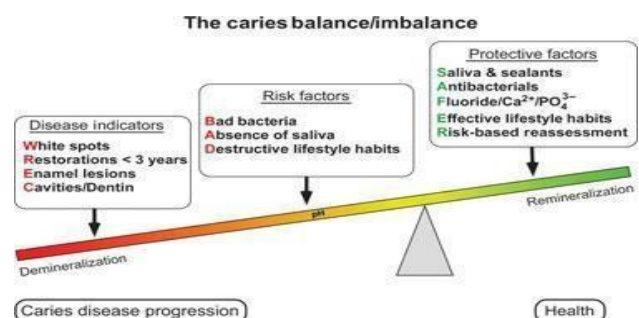
ABSTRACT

The prevalence of dental caries in preschool-aged children is relatively high, and it can impact their growth, development, and quality of life. It is necessary to reduce the risk of caries by assessing and managing its risk factors. One effective method is CAMBRA (Caries Management by Risk Assessment) that can reduce the risk of dental caries. This study aims to obtain risk factors dental caries based on CAMBRA in preschool children. This study was an observational cross-sectional study with a sample of 57 preschool children in ABA Niten Kindergarten in the Yogyakarta. A total sampling method was used, the dependent variable was the number of caries and the independent variable were adopted from CAMBRA, namely: white spots, dental fillings, dental plaque/gingival inflammation, low salivary flow, salivary pH, and deep fissures. Data were collected using a checklist and analyzed using the Chi-Square test. The result were 46 children (80,7%) had dental caries, 41 children (71.93%) had teeth with white spots, 32 (56.14%) had no dental plaque, 34 (59.63%) had low salivary flow, 40 (70.18%) had a low salivary pH , 42 (73.68%) had no dental fillings, and 30 (52.63%) had deep fissures. The Chi-square analysis revealed that white spots, dental fillings, dental plaque, low salivary flow, salivary pH, and deep fissures were significantly associated with the dental caries ($p < 0.05$). white spots, dental fillings, dental plaque, low salivary flow, salivary pH, and deep fissures are related to the occurrence of dental caries.

Keyword : Risk factors dental caries; disease indicator CAMBRA, preschool children

Introduction

The concept of caries balance/imbalance provides a visual representation of the multifactorial nature of caries. It illustrates the determinants of caries and the dynamic interaction between biofilm and the oral environment. This oral environment directly influences the nature of the biofilm on each tooth surface and, when conditions are severe, can lead to demineralization and visible changes. Dental caries results from an imbalance among



caries indicators, risk factors, and protective factors, leading to the onset of caries, which is typically preceded by a white spot [1]. When pathological factors outweigh protective factors, the caries process accelerates. This is a dynamic and sensitive balance that reverses directions several times a day. Ultimately, the occurrence of caries is determined by the balance and imbalance between indicators and risk factors versus protective factors [2]. *The Caries balance/imbalance* [3] Dental caries, along with periodontal disease, are the most common dental and oral diseases in the community, including in children. Dental caries is an infectious disease that has become a global health problem. Its prevalence is five times higher than that of asthma and seven times higher than that of rhinitis allergy. An estimated 89% of Indonesian children under the age of 13 suffer from dental caries [4].

The 2023 Indonesian Health Research noted that 37.4% of children aged 3–4 years (or preschool-aged children) experienced dental caries, while only 1.4% received dental fillings[5]. Untreated dental caries in children can lead to many unfavorable outcomes, such as pain, the possibility of infection, the formation of infectious foci in the body, disruption of daily activities, psychomotor problems, and growth disorders. Dental caries is one of the problems that often arise during child development, in addition to other issues like malnutrition, obesity, and allergies [6].

Dental caries is a multifactorial disease. One of its key etiologic factors is the substrate, specifically carbohydrates, which serve as the most important medium for cariogenic bacteria. Caries is an irreversible microbiological disease of calcified tooth tissue characterized by the demineralization of inorganic material and the destruction of organic tooth material, which ultimately leads to the formation of cavities[7].

Research on risk factors for dental caries using the CAMBRA (Caries Management By Risk Assessment) approach has been conducted by Adyatma in urban areas of Jakarta. The results of this study identified various factors that influence children's dental health. First, child-related factors including habits and behavior showed that the frequency of sugar consumption, such as frequently consuming sweet and sticky snacks, greatly influences the risk of developing caries. Second, maternal or parental behavior factors and parenting

patterns, namely the frequency of giving sweet foods or drinks to children, significantly affect the risk of caries in preschool children as an indication of high caries risk.[8][9]. This study was conducted in rural areas within Sleman Regency, Special Region of Yogyakarta.

The aim of this study was to determine the relationship between CAMBRA oral risk factors and the occurrence of dental caries in preschool children.

Methods

This study utilized a quantitative, observational cross-sectional research design. The study did not manipulate variables but instead directly observed reality from the respondents, focusing on the dental and oral caries risk factors in preschool children based on the CAMBRA method. The study population consisted of preschool children from ABA Niten Kindergarten in Gamping District, Sleman Regency, Yogyakarta Special Region Province. A total sampling technique was used to select the sample of 57 preschool children. Inclusion criteria for the sample were preschool children aged 3–5 years who had at least one decay ($dmf-t \geq 1$), were not currently undergoing treatment for systemic diseases, were willing to participate as research respondents, and had received parental consent. The research instrument was a checklist of dental and oral factors. The dependent variable was the number of caries, categorized as low ($decay < 3$) and high ($decay \geq 3$)[10]. The independent variables were

White spots/white color on the tooth surface

1. The presence of dental plaque/gingival inflammation
2. Low saliva flow (volume less than 1 ml/minute)
3. The presence or absence of deciduous tooth fillings
4. Saliva pH less than 6.5
5. The presence or absence of deep fissures in deciduous molar teeth.

Data were analyzed using the Chi-square test in SPSS 25.0. This research was conducted after obtaining ethical clearance from the Ethics and Health Research Commission of the Yogyakarta Ministry of Health Polytechnic on March 20, 2025.

(<https://drive.google.com/file/d/1a8jPftFpJxj8o3DPhLsMsPdQAfMhYWy/view?usp=sharing>).

Table 1. Distribution of Respondent Characteristics

Respondent Characteristic	n	%
Gender	27	47,37
Male		
Female	30	52,63
Mother's education	0	0
Elementary School		
Middle School	6	10,53
High School	28	49,12
Bachelor's Degree	23	40,35
Parents' Occupation	3	5,26
Distributor		
Civil Servants/Police/Military Forces	4	7,02
Private Employees	23	40,35
Small Traders	7	12,28
Laborers	18	35,09
Parents' Income	30	52,63
IDR 0-Rp.1.999.999		
IDR 2.000.000-Rp.4.999.999	16	20,07
IDR >.5.000.000	11	27,30
Dental Health Facilities	17	29,82
Private Dental Clinic		
Community Health Center	34	59,65
Hospital	6	10,53
Number of visits to dental health facilities (last year)	33	57,89
0-1 kali		
>1 kali	24	42,11

Table 2. Frequency distribution of disease indicator factors

Variabels	Yes	No	n	%
white spot	41	71,93	16	28,07
There is dental plaque/gingival inflammation	25	43,86	32	56,14
volume <1 ml/menit	34	59,63	23	40,37
pH saliva < 6,5	40	70,18	17	29,82
Deciduous tooth filling	15	26,32	42	73,68
Deep fissure	30	52,63	27	47,37

Table 3., Description of dental caries frequency

Variabels	High caries risk		Low caries risk	
	n	%	n	%
Dental caries	46	80,7	11	19,3

Risk Factors	Criteria	Dental caries		<i>p-value (sig)</i>	χ^2
		Low n (%)	High n (%)		
White spots on the enamel surface	Yes	4(36,4)	37(80,4)	0,007*	7,77
	No	7(63,6)	9(19,6)		
There is dental plaque/gingival inflammation	Yes	1(9,1)	24(47,8)	0,016*	7,72
	No	10 (90,9)	22(34,8)		
Low salivary flow / volume <1 ml/minute	Yes	8(72,7)	26(71,7)	0,012*	7,36
	No	3 (27,3)	20 (43,5)		
pH saliva	High	3(33,33)	14 (31,82)	0,01*	8,18
	Low	6 (66,67)	34 (68,18)		
Deciduous tooth filling	Yes	5(45,55)	10(21,78)	0,04*	4,34
	No	6 (54,45)	36(72,22)		
Deep fissure	Yes	2(22,22)	28(60,87)	0.017*	6,85
	No	9(77,78)	18(39,13)		

Based on Table 1, it was found that 30 respondents (52.63%) were female. Regarding parents, 28 mothers (49.12%) had a high school education, 23 parents (40.35%) were private sector employees, and 30 families (52.63%) had a family income of less than IDR 2,000,000. The Community Health Center was the most frequently visited health facility, with 34 children (59.65%). Furthermore, 33 children (57.89%) had visited a dental health facility 0-1 times during the past year.

The frequency distribution presented in Table 2., shows that 41 respondents (71.9%) had white spots on their tooth surfaces. In addition, 32 respondents (56.1%) had no tooth inflammation, and 34 respondents (59.63%) had a low saliva volume (less than 1 ml/minute). A total of 42 respondents (73.68%) had no deciduous tooth fillings, and 27 respondents (47.37%) had molar teeth with deep fissures.

Table 3 shows that the distribution of caries frequency is 46 (80.7%) respondents experienced dental caries with high criteria.

Table 4 shows that the variables white spot, dental plaque/gingivitis, saliva volume less than 1 ml/minute, salivary pH, deciduous tooth fillings, and deep fissures are significantly related to the occurrence of dental caries in preschool children ($p < 0.05$).

1. Description of the frequency of respondents and dental caries in preschool children

The results of the study in table 1 show that 59.65% had low education, and 52.63% had family income levels of less than IDR 2.000.000. Mothers' education is a crucial factor in a child's health, particularly regarding dental and oral

care. Those with less education often have insufficient knowledge of proper oral hygiene, which can lead to a lack of effort in preventing caries. This can manifest as inconsistent supervision of children's tooth-brushing routines and a low frequency of visits to the dentist. The findings are consistent with previous research showing that lower education is correlated with a limited understanding of oral hygiene, thereby increasing the risk of poor dental health among children[11].

The study findings indicate that a majority of children (59.65%) utilized community health centers (Puskesmas) for dental care, with a high proportion (57.89%) visiting fewer than twice a year. These results are likely influenced by family income status, which has a significant impact on children's dental health. Low-income families often face financial barriers that limit their access to quality dental health services, including routine and preventative care. Furthermore, challenging economic conditions can lead to unhealthy food choices, such as high-sugar foods, which elevate the risk of dental caries in children [12]. In contrast, the study suggests that families with better economic status tend to have improved access to healthy food and health care, thereby reducing the risk of dental problems[13].

Mothers with low education and low income may be less able to provide optimal healthcare for their children. Maternal education, in particular, influences the health decisions made within the family, including children's eating habits and oral hygiene[14]. Furthermore, financial constraints limit a family's ability to support the education and health services their children need, which ultimately contributes to a high rate of dental caries [15][16].

The high prevalence of dental caries among preschool children highlights the urgent need for more effective public health interventions. Educational programs for mothers on dental health and the importance of dental care should therefore be prioritized. Additionally, access to affordable dental health services must be improved, particularly among low-income groups[12].

2. Results of chi-square analysis between disease indicator factors and dental caries in preschool children.

According to the results in Table 2., 41 children (71.93%) presented with white spots on their tooth surfaces, a factor that was significantly associated with the occurrence of dental caries ($p<0.05$). The presence of white spots is a crucial early sign of tooth enamel demineralization and often indicates the initial stages of caries. The findings are consistent with previous research showing that white spots are a significant risk factor for dental caries in preschool children, potentially increasing their risk of developing the condition threefold [17]. This increased risk is often attributed to the high prevalence of white spots in children who have a habit of consuming cariogenic foods and exhibit poor oral hygiene [18].

The results of this study indicate that 25 children (43.86%) presented with plaque or gingivitis (Table 2). The Chi-square test further revealed a significant relationship between plaque/gingivitis and dental caries in preschool children ($p<0.05$) (Table 4). The presence of plaque on the tooth surface is highly correlated with the incidence of gingivitis, which in turn increases the risk of dental caries[19][20]. Effective cleaning of dental plaque through tooth brushing can reduce gingivitis and prevent the onset of dental caries in children [21]. Therefore, it is crucial to provide engaging education from an early age to increase knowledge about maintaining dental and oral health and prevent the progression of these conditions [16].

The concept of caries balance/imbalance serves as a visual representation of the multifactorial nature of caries. The illustrates the various determinants of the disease and the dynamic interaction between the oral biofilm and its environment. This environment, in turn, dictates the nature of the biofilm on each tooth surface and, when severe enough, can cause demineralization and visible changes. Demineralization, therefore, occurs due to an imbalance between protective factors and pathological risk factors [1][20].

The salivary flow data from this study

indicates that 34 children (59.63%) had low salivary flow (less than 1 ml/minute) (Table 2). Chi-Square test further revealed a significant relationship between low salivary flow and dental caries ($p=0.012$)

(Table 4). Low salivary flow is a critical factor in maintaining dental hygiene and health [20]. Children with reduced saliva production are at a higher risk of dental caries due to saliva's diminished ability to neutralize acid and remineralize tooth surfaces. Salivary flow can be stimulated through the use of sugar-free chewing gum, a method proven to aid in caries prevention. Children participating in a program designed to increase salivary flow have shown a significant decrease in caries incidence [23][15].

According to the results in Table 4, a significant relationship was found between salivary pH and the occurrence of dental caries in preschool children ($p<0.01$). A low salivary pH indicates a more acidic oral cavity environment, which can accelerate the demineralization of tooth enamel. Children with a salivary pH below 6.5 show a higher prevalence of caries, making the enamel surface vulnerable and initiating the caries process[9]. Furthermore, a low salivary pH is associated with the presence of pathogenic microbes linked to caries, making salivary pH an important parameter for assessing caries risk[24].

In this study, a high percentage of children, 42 (73.68%), had unfilled dental caries (Table 2). This is significantly higher than the 2023 SKI results, which indicated that only 12.9% of children aged 3-4 years had received fillings [5]. The findings from Table 4 show a significant relationship between the presence of deciduous tooth fillings and the occurrence of dental caries ($p<0.05$). The presence of fillings in deciduous teeth not only reflects a child's oral health but can also serve as an important indicator of past dental problems. Children with untreated caries in their primary teeth are at a high risk of developing caries in their permanent teeth [11]. Therefore, proper maintenance and filling of deciduous teeth are crucial for preventing further caries progression [25][26].

Based on the study's findings in Table 2, 30 children (52.63%) were found to have deep fissures. While deep fissures can accommodate plaque and bacteria, thereby increasing the risk of caries, the results of the Chi-square test (Table 4) revealed statistically significant relationship between deep fissures and dental caries ($p=0.017$). Molar teeth with deep fissures are positively correlated with the incidence of caries, and

children with untreated deep fissures show a higher prevalence of caries[27]. The application of sealants to prevent plaque accumulation in fissures is a necessary intervention for children with deep dental fissures [11].

Conclusion

Based on the research results and discussion, it is concluded that the risk factors white spots, dental fillings, dental plaque, low salivary flow, salivary pH, and deep fissures are related to the occurrence of dental caries in preschool children.

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