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Research Article

Overview of Dental Caries and Treatment Needs in Early Childhood

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KEYWORDS

Caries, children, early childhood, treatment need.

ABSTRACT

Introduction: The prevalence of dental caries in children remains high in Indonesia. Primary teeth are particularly vulnerable to caries, yet parental awareness of children's oral health is often insufficient. As a result, children with caries often do not receive proper treatment. It is unfortunate when caries occur at an early age. This study aims to describe the occurrence of dental caries and the need for dental treatment in early childhood.
Material and Methods: This study utilized a descriptive-analytic method with a cross-sectional approach, which involved 52 children, aged 3 to 5 years. Dental caries were assessed using the def-t index, while treatment needs were evaluated with the Required Treatment Index (RTI). The data collected were analyzed descriptively and further examined using the Mann-Whitney and Spearman's rank correlation test.
Results and Discussions: The prevalence of dental caries in children was 57.69%, with an average def-t score of 2.62. Caries were most commonly found in the upper jaw, particularly affecting the primary first incisors, followed by the primary molars. The treatment needs index (RTI) was 99.26%, indicating that most carious teeth were left untreated, requiring dental treatment. There was no significant caries difference between boys and girls ($p > 0.05$). However, a significant correlation was found between age and caries frequency ($p < 0.05$).
Conclusion: The average caries rate in primary teeth falls within the low category. However, nearly all affected teeth require treatment. Among children aged 3 to 5 years, caries prevalence tends to increase with age, and no difference between boys and girls.

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INTRODUCTION

Dental caries in children and the lack of proper treatment remain significant concerns. Early childhood caries can have serious consequences, causing teeth to become fragile, develop cavities, or even break, leading to difficulties in chewing and digestive issues.[1] As a result, nutrient absorption may be disrupted, potentially affecting a child's overall growth. Dental damage at an early age can interfere with the proper development of teeth in later stages.[2] Additionally, dental caries can lead to a loss of playtime for children due to the pain and discomfort it causes, impacting their overall well-being and daily activities.[3] Caries is also the major cause of tooth extractions in both children and adults. [4] Therefore, dental care should begin as soon as a child's teeth start to emerge to prevent future complications and ensure optimal oral health.

Early childhood caries (ECC) has become a global concern, affecting nearly half of preschool-aged children worldwide. Reports indicate that 29 out of 195 countries have shown an increasing prevalence of this condition. The prevalence of ECC varies significantly between countries, [5] due to differences in socioeconomic factors, healthcare access, and oral health practices. In Indonesia, the prevalence of early childhood caries has reached 92.7%, with a def-t index of 8.1 at the age of five. [6] This indicates that, on average, each child has 8 to 9 decayed teeth, highlighting the severity of the issue and the urgent need for preventive and restorative dental care. Although the 2023 Indonesian health survey reported a decline in the def-t index to 6.7 for this age group,[7] it still very high category, indicating that early childhood caries remains a significant public health concern. A study conducted in Serang Regency found that preschool children had an average caries rate of 8.83, with a filling rate close to zero (f-t 0.02). [8] This indicates that although caries is highly prevalent, very few cases receive restorative treatment.

Oral health issues have been reported by more than half (56.9%) of Indonesia's population aged three years and older. However, only 11.2% seek professional dental care, while the majority choose or self-medication by purchasing pain relievers without a dentist's prescription.[7] Fear of dental visits and limited parental knowledge about oral health contribute to untreated dental caries in children,[9] further exacerbating the problem.

Children's cavities are often overlooked by parents and perceived as a normal occurrence by society, leading to a lack of treatment. [9] However, given the crucial role of primary teeth in a child's growth and development, maintaining their health is essential. This study aims to provide an overview of dental caries and treatment needs in early childhood, as well as to determine the severity, the required treatment, and gender differences.

MATERIAL AND METHODS

This study employs a descriptive-analytic research design with a cross-sectional approach. It involves 52 children aged 3 to 5 years from Damar Kindergarten in Denpasar, Bali. The participants include all children present at the school who agreed to undergo the examination. Dental assessments were conducted with parental consent to ensure ethical participation. The study was approved by the Ethics Committee of the Faculty of Dentistry of Universitas Mahasaraswati Denpasar (Ethics No. [2024] K.535/A.17.01)

The def-t index was used to assess the history of dental caries. The index consists of three components: decay (d), referring to primary teeth with untreated cavities; extracted (e), representing teeth that have been or will be removed due to caries; and filling (f), indicating teeth that have been restored with intact fillings. The caries frequency for each child was determined based on the number of teeth with a history of caries.

Examinations were conducted by two calibrated dentists to ensure consistency and accuracy. To create a comfortable environment, the assessments began with children who felt confident, encouraging others to participate afterward. The collected data were analyzed descriptively and further examined using the Mann-Whitney test and Spearman's rank correlation.

RESULTS AND DISCUSSIONS

The number of children involved in this study was 52, with more boys was 30 and girls 22 (30:22). The age of the participants ranged from 3 to 5 years, with an average of 4.06 years (SD: 1.16). Initially, more than half of the children were fearful and uncooperative during the examination number of children? (55.77%). Boys were more likely to be afraid than girls. However, they eventually agreed to be examined after being persuaded. It is important to note that the socioeconomic background of the children's parents at this school is upper-middle class, and maternal educational level was university graduate. These participant characteristics are presented in Table 1.

Table 1. Distribution of participant characteristics

Gender	Age (year)		Fear in examination			Moternal	Socioeconomic
	Range	Mean ± SD		N	Prevalence (%)	Education	status
Boys	3-5	4.06 ± 1.16	Fear	17	32.69	tertiary education	upper-middle class
			No fear	13	25.00		
Girls			Fear	12	23.08		
			No fear	10	19.23		
Total				52	100.00		

In this study, 55.77% of participants exhibited fear during dental examinations. This finding is supported by other research, which reported that 70.4% (N=798) of participants experienced fear when someone examined their mouth. Fear of dentists and dental treatment has been linked to a higher prevalence of caries, with fearful children being 1.8 times more likely to develop caries compared to those without fear.[10]

All primary teeth in the children had erupted, except for one child (5 years old) who had only 18 teeth (the second upper molars had not yet erupted). The distribution of caries frequency in primary teeth based on age, gender, and tooth element is presented in Tables 2, 3, and 4 as follows:

Table 2. Distribution of caries frequency by Age

Gender	Age (years)	N	Caries frequency						Prevalence (%)	RTI (%)
			d	e	f	def-t	Range	Mean ± SD		
Boy	3	12	21	0	1	22	100	0-16	2.62 ± 3.46	57.69	99.26
	4	5	17	0	0	17					
	5	13	61	0	0	61					
Girl	3	9	4	0	0	4	36				
	4	8	22	0	0	22					
	5	5	10	0	0	10					
Total		52	135	0	1	136					

Table 2 illustrates that boys had a higher caries rate than girls. Caries experience was predominantly characterized by untreated decay, with no recorded extractions and only one filled tooth, resulting in a performance treatment index (PTI) of 0.74%. The mean def-t score of 2.62 suggests that, on average, each child had caries affecting approximately 2 to 3 teeth. The RTI value of 99.26% indicates that nearly all primary teeth affected by caries had not yet received appropriate treatment.

This study identified a significant occurrence of rampant caries, with some cases affecting up to 16 teeth, notably observed in a 5-year-old boy. Additionally, rampant caries were detected in very young children (aged 3 years), with one case involving 8 decayed teeth in a boy. A considerable proportion (20%) of children exhibited caries in five or more teeth. Nevertheless, 42.31% of children remained caries-free.

Table 3. Distribution of caries frequency in maxillary tooth elements

Gender	Age (years)	N	Tooth elements.										Total
			55	54	53	52	51	61	62	63	64	65	
Boy	3	12	0	1	0	3	5	4	3	1	2	1	20
	4	5	1	2	1	2	2	2	1	1	1	1	14
	5	13	1	4	3	5	6	5	3	0	5	2	34
Girl	3	9	0	1	1	0	1	1	0	0	0	0	4
	4	8	1	1	1	1	1	3	3	1	2	1	15
	5	5	1	2	0	0	2	2	0	0	2	1	10
Total		52	4	11	6	11	17	17	10	3	12	6	97

Table 3 indicates that caries in primary maxillary teeth were most frequently found in the first incisors, although molars were also highly affected. In the posterior region, caries were more prevalent in the first molars compared to the second molars. Additionally, the maxillary second molars had not yet erupted in two boys aged 5 years.

Table 4. Distribution of caries frequency in mandibular tooth elements

Gender	Age (years)	N	Tooth elements.										Total
			75	74	73	72	71	81	82	83	84	85	
Boy	3	12	1	0	0	0	0	0	0	0	2	0	3
	4	5	1	1	1	0	0	0	0	0	1	0	4
	5	13	4	5	0	1	1	1	1	0	8	5	26
Girl	3	9	0	0	0	0	0	0	0	0	0	0	0
	4	8	1	0	0	0	0	0	0	0	2	3	6
	5	5	0	0	0	0	0	0	0	0	0	0	0
Total		52	7	6	1	1	1	1	1	0	13	8	39

Table 4 shows that in the posterior region, caries in primary mandibulary teeth were more than anterior. The right first molar in the posterior region had the highest caries experience. No caries were found in the lower right canine.

The Kolmogorov-Smirnov normality test indicated that the sample was not normally distributed ($P < 0.05$). Consequently, nonparametric statistical tests, namely the Mann-Whitney and the Spearman rank test, were employed. The results of the statistical analysis are presented in Tables 5.

Table 5. Mann-Whitney and Spearman rank statistical test

		N	Correlation coefficient	*P*
Mann-Whitney U	Boy	30		0.195
	Girl	22		
Spearman's rho age-caries		52	0.321	0.010

The Mann-Whitney statistical test was used to determine the difference in caries between boys and girls. Table 5 indicates that there was no significant difference in caries between boys and girls ($P > 0.05$).

The Spearman rank statistical test was used to examine the relationship between age and caries. Table 5 shows a significant correlation between age and caries in children aged 3 to 5 years ($P < 0.05$). The positive correlation coefficient indicates that as age increases, the frequency of caries also tends to rise.

Children are highly susceptible to caries.[11] Primary teeth are more prone to caries than permanent teeth due to their immature structure, which still contains a high amount of carbonate ions. [12] Additionally, primary teeth have less dense enamel, a thinner structure, and more irregular morphology, with proximal contact being surface contact.[13] Dental caries is the leading cause of primary tooth loss.[14]

The prevalence of caries in this study (57.69%) was significantly lower than the national prevalence (92.7%).[6] Similarly, the mean caries score in this study (2.62) was much lower than the national average (8.1), indicating a relatively low caries rate. However, 20% of children in this study had caries in five or more teeth, some of which were classified as rampant caries. A study conducted in Kalidoni District among children aged 3–4 years reported

an 83% prevalence of rampant caries. [15] Limited knowledge, combined with parental beliefs and negative behaviors, poor feeding and oral hygiene practices, and lack of professional dental care, places children at a higher risk of developing caries. Behavioral factors play a crucial role in determining an individual's overall health status.[16]

The frequency of caries in this study was predominantly characterized by decay (d: 135), no cases of extracted teeth (e: 0) and an almost negligible filling rate (f: 0.02). The RTI value was extremely high (99.29%), indicating that out of 136 carious teeth, only one had received treatment. These findings are supported by a study conducted in Mexico, which reported a high treatment needs index (81.91%, N = 14.852) and further demonstrated that the presence of caries in primary teeth was positively associated with caries in the permanent dentition.[17]

Another study revealed that primary teeth in children aged 3–7 years continued to exhibit a high prevalence of caries, accompanied by low and unsatisfactory levels of dental care (Santamaría, 2024).[18]

The study findings indicate that the high RTI was attributable to the large number of untreated teeth. Untreated dental caries in children can lead to pain, infection, and difficulties in eating and speaking, as well as negatively impact their ability to concentrate in school. In the long term, these issues can have detrimental effects on cognitive development, school readiness, self-esteem, and ultimately reduce the quality of education and quality of life.[19]

The high RTI value also reflects a lack of parental attention to children's dental health. Mothers with good knowledge, high motivation, and supportive factors are more likely to encourage positive dental health behaviors in their children.[20] A lack of knowledge about oral health often leads to misconceptions about proper dental care.[9] Different studies have shown that even when parents are aware that brushing teeth can prevent caries, their daily practices often do not reflect this understanding. In fact, 58% (N:129) of mothers resort to self-medication for their children's dental caries, while the rest leave them untreated.[21] To this day, dental and oral health remain a low priority for many people. Dental caries, including untreated cavities, are still prevalent not only among children but also in adults.[22] The progression of caries in children continues despite increased awareness of the issue. Awareness alone is insufficient if not accompanied by genuine care and proactive action.

The inability to afford dental care is often cited as a primary reason for not seeking treatment (76.7%, N= 877.531).[7] However, this contradicts the socioeconomic background of the participants in this study, who belong to the upper-middle class and should have the financial means to access dental care. Fear may also contribute to delays in seeking treatment.

In this study, caries prevalence was higher in the maxillary teeth compared to the mandibular teeth. Additionally, in the maxillary region, the anterior teeth were more severely affected than the posterior teeth. The maxillary central incisors were the most frequently impacted, as they are the first teeth to erupt, making them more exposed to cariogenic substances for a longer period than posterior teeth. [23] These findings align with the other study,[24] which reported that caries prevalence is higher in anterior compared to posterior teeth. This may be attributed to the fact that anterior tooth surfaces tend to be drier, except for the lower anterior teeth, which benefit from tongue movement during eating and are positioned near the submandibular gland duct, providing natural cleansing effects.

In the mandible, caries were more prevalent in posterior than in anterior teeth. Other studies have also reported a higher prevalence of caries in primary posterior teeth. The complex morphology of posterior teeth, including deep grooves and occlusal anatomy, makes them more susceptible to caries. [25] Posterior teeth have broad chewing surfaces with numerous cusps and fissures, which can easily trap food particles, increasing the risk of caries.[26]

Statistical analysis showed no significant difference in caries prevalence between boys and girls, despite boys having a higher frequency of caries than girls. This lack of difference may be attributed to similar parental behaviors regarding children's oral health care. However, the higher caries prevalence in boys may be influenced by local Balinese cultural norms, where boys

are often treated more indulgently than girls. Parents are more likely to accommodate boys' preferences, including their fondness for sweet foods and reluctance to brush their teeth, especially if they cry in protest.[9]

Conversely, other studies have reported that girls tend to have more caries than boys. This has been linked to the earlier eruption of teeth in girls, resulting in a longer exposure period in the oral environment.[27,28] Additionally, research suggests that Lactococcus lactis, a cariogenic and acid-producing bacterium, is more abundant in caries-active girls than in boys, indicating that this microorganism may play a significant role in shaping the cariogenic microbiome in girls.[29]

There is a correlation between age and caries in children aged 3–5 years, where caries dental increases with age. Due to the high susceptibility of primary teeth to caries, the longer they remain in the oral cavity, the greater the risk of caries development. However, this trend differs from studies conducted on children aged 6–12 years, where no significant correlation between age and caries was found. Although caries can increase with age, if preventive measures are not taken to address other contributing factors, the risk of caries remains present.[30]

Tooth eruption is the process by which teeth move from within the jaw to their functional position in the oral cavity, along with subsequent post-eruptive movements.[31] It is often used as an indicator for estimating a person's age.[32] Currently, tooth development patterns do not always follow a predictable evolutionary sequence. In this study, a child was found to have incomplete primary dentition at the age of 5 years, with unerupted maxillary second molars. This may indicate a growth disturbance, as the maxillary second molars are typically the last primary teeth to erupt, usually between 25–33 months.[33] The timing of tooth eruption varies among children and is influenced by factors such as nutrition and ethnicity. Different ethnic groups have distinct dietary habits, which can contribute to variations in eruption patterns.[34]

Healthy primary teeth play a crucial role in the development of permanent teeth and overall health. Oral health is an integral part of general well-being.[34] The condition of the teeth can serve as an indicator of overall health. Therefore, maintaining good oral health in children is essential from an early age. It should be preserved for as long as possible until the permanent teeth erupt, ensuring proper dental development and overall well-being.

CONCLUSION

The occurrence of early childhood caries tends to be higher in the maxillary teeth than in the mandibular teeth. Although the average caries rate falls into the low category, the decay component dominates the def-t index, resulting in a very high RTI (99.29%). A significant correlation was found between age and caries prevalence, indicating that caries increases with age. However, no significant difference was observed between boys and girls, despite boys having a slightly higher caries rate than girls.

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