

Exploring Socio-Cultural Factors Affecting Early Childhood Oral Health: A Mixed-Methods Study

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Abstract: *Purpose:* Early Childhood Caries (ECC) remains a major child health problem in Indonesia despite ongoing preventive efforts. ECC is closely associated with poor dietary habits, excessive and unmonitored sugar consumption, and even influences social and cultural aspects. This study aimed to explore socio-cultural, behavioral, and nutritional factors affecting early childhood oral health within Holistic Integrative Early Childhood Education (PAUD HI) settings in Padang City, Indonesia. *Methods:* A sequential mixed-methods study was conducted. The quantitative phase involved 258 parents of children aged 1–6 years selected from six PAUD HI institutions. Data were collected using questionnaires, and analysis was performed using univariate, bivariate, and multivariate logistic regression. Following this was the qualitative phase, in which 12 parents and 3 school representatives were asked to explain and contextualize the initial quantitative findings. In analyzing this data, Miles and Huberman's thematic approach was used.

Results: There was no statistically significant association between parental oral health behavior and knowledge (OR=8.607, $p=0.165$), attitude (OR=2.207, $p=0.132$), belief (OR=0.425, $p=0.230$), health information exposure (OR=2.512, $p=0.186$), healthcare support (OR=2.031, $p=0.201$), or access to health facilities (OR=5.330, $p=0.126$). The results reveal that no final multivariate regression model was obtained. Sociocultural factors strongly influence habits through family toothbrushing routines, parenting power dynamics, children's emotional attachment, traumatic dental experiences, and inconsistent control of children's sugar consumption, which are all the results of influences within and outside family settings. These findings elucidate why there is a gap between what parents understand and how they actually implement oral health care practices properly on their children.

Conclusion: Risk factors for ECC do not only come from parents' dental knowledge but also from children's social and cultural environments. Implementing effective socio-cultural approaches reduces ECC risks, for example, by providing education to parents and children on proper nutritional habits and how to incorporate them into daily routines.

Keywords: Child nutrition, early childhood caries, feeding habits, mixed methods, oral health, socio-cultural factors, sugar consumption.

INTRODUCTION

Generally, dental caries is considered a common oral health problem influenced by poor dietary habits and family genetic factors. It is characterized by white, brown, or black spots on the teeth that may progress to cavities. This condition affects people of all ages worldwide. Globally, dental caries affects approximately 2 billion adults and 510 million children [1]. In Indonesia, children aged 5–9 years have the highest prevalence of caries, with 49.9% affected. Similarly, 48.4% of five-year-old children worldwide have been reported to experience dental caries [2]. The high vulnerability of children is due to their primary teeth, which are more susceptible to caries because of their less-dense enamel [3, 4].

Preventive dental care for children under 10 requires significant involvement from parents. At this young age, children are still learning to take care of themselves, and parents' guidance on a proper way of life is important. Thus, it is the right time to teach children proper toothbrushing technique and timing, along with healthy foods to consume daily. Previous research has shown that maintaining oral hygiene can be achieved by developing children's motor skills through tooth brushing [5]. Such practices are intended to gradually build children's understanding of preventive measures against dental problems, including caries. In addition, Yuniarly (2021) states that the mother's role in educating children has also contributed to preventing caries, as mothers closely teach children how to properly brush their teeth and which foods to consume [6].

Another preventive measure can be effective when parents are aware of their children's dental condition.

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There is a widespread, misleading belief that caries in baby teeth is not a serious issue, which contributes to its high prevalence among children. Consequently, it often goes untreated and eventually disrupts nutritional status by impairing chewing ability, thereby affecting children's nutrient intake [7]. There were cases of premature loss of primary teeth due to caries, which interfered with jaw development and eventually led to problems with permanent teeth [8]. Without significant interference from parents or family members in monitoring, children's oral health may be affected, and, in the worst cases, eventually lead to limited cognitive and behavioral capacity to care for themselves independently.

Previous studies have recognized poor dietary habits as the primary contributor to Early Childhood Caries (ECC) risk. Several nutritional factors, for example, sugar intake patterns and feeding behaviors, are seen to highly influence ECC in preschool children. This interconnectedness suggested the need to perceive oral health and nutritional habits as connected rather than separate fields of discussion [9 - 11].

Children's oral health assessment should consider family influences and attitudes towards their children's oral habits in addition to clinical indicators alone [12]. Mothers, as stated by the Indonesian Dental Association (PGDI), particularly have the biggest influence [13]. Early Childhood Caries (ECC) is thus understood as a non-contagious disease caused by the combination of social and cultural factors related to poor dental care and high sugar consumption, leading to the growth of *Streptococcus* and *Lactobacillus* bacteria [14]. For the theory, Peter L. Berger and Thomas Luckmann's social reality theory is suitable for this analysis [15]. For the theory, social context is not a single, independent factor but a product of complex interactions among individuals in their daily routines.

In addition to parents as the main protectors of their children's oral health, external factors also play a role [16]. Schools, for example, are the main facility for children to develop their motor skills, especially those related to dental hygiene [17, 18]. The earlier education is delivered, the lower the risk of caries, and the most fundamental educational level for providing dental hygiene familiarity to children is in Early Childhood Education (PAUD) [19]. Previous research has shown that schools play a significant role in promoting clean, healthy living behaviors through structured education and physical demonstrations [20]. Moreover, the Early

Childhood Education program in Indonesia adopts a Holistic Integrative approach, as stipulated in Presidential Regulation No. 60 of 2013, encompassing education, health, nutrition, care, parenting, protection, and child welfare.

Holistic Integrative PAUD (PAUD HI) programs in Indonesia serve this exact purpose. PAUD programs are designed to equip children with greater knowledge and behaviors to prevent dental caries [21]. Not only do PAUD HI schools reinforce dental hygiene education, but they also conduct toothbrushing demonstrations, provide regular dental check-ups, and even restrict the types of food consumed during school hours [22].

However, despite these structured interventions, the prevalence of dental caries among early childhood children in Indonesia remains relatively high. One of the regions implementing PAUD HI programs is Padang City, West Sumatra Province, Indonesia. According to data from the Ministry of Education and Culture (KEMENDIKBUD) (2025), Padang City has the highest number of PAUD institutions in the province, with 542 out of 5,087 institutions distributed across 19 regencies/cities [23]. Furthermore, West Sumatra is among the regions with the highest prevalence of dental caries in Indonesia, with 48.2% among 17,114 individuals [2]. Urgent action is needed, and it is essential for West Sumatra to strengthen its early childhood education foundations so it can tackle the caries problem.

Most studies have addressed questions about the clinical and behavioral effects of dental caries. On the other hand, this study looks at how ECC was influenced by socio-cultural aspects in Holistic Integrative Early Childhood Education (PAUD HI) of West Sumatra. The analyses examine how cultural norms, parenting dynamics, educational practices, and daily social interactions influence children's oral health behaviors. These findings help explain the underlying factors behind Indonesia's persistent dental caries among children.

In identifying the socio-cultural context, a mixed-methods approach was appropriate, as quantitative findings did not provide a thorough explanation of the discrepancies between parental knowledge and actual oral health practices. Using the qualitative method helped researchers delve deeper into the numbers underlying the quantitative findings.

MATERIALS AND METHODS

Study Design

An explanatory sequential mixed-methods design approach was used, consisting of quantitative and qualitative analyses. First, the quantitative phase was done to identify measurable behavioral determinants associated with parental oral health practices. Afterward, a qualitative phase was done to further analyze the underlying social and cultural factors influencing the behaviors found in the quantitative findings.

Study Setting

The study was conducted in three PAUD HI institutions in Padang City, West Sumatra, Indonesia: RA Ar Risalah (Kuranji District), TK Islam Nibras (Padang Timur District), and TK IT Adzkia III (Padang Barat District). These institutions were selected because they implement PAUD HI programs that integrate educational, health, nutrition, parenting, protection, and child welfare services.

Participants and Sampling

The quantitative phase involved parents of children enrolled in six PAUD units, with a total of 482 respondents participating either directly or through an online questionnaire (Google Form). Participants are given a questionnaire, which was first tested for validity using the Pearson Product-Moment Correlation analysis by comparing the calculated r with the table r ($0.361/n=30$), and for reliability using Cronbach's Alpha

(>0.60) on 30 samples, with appropriate criteria. After tabulation and data cleaning, 258 questionnaires were fully completed by respondents and included in the final analysis.

For the qualitative phase, purposive sampling was done, and participants were divided into two categories: actor informants and observer informants. Actor informants were parents whose children were either caries-free or affected by dental caries, while observer informants were school representatives who directly interacted with the children, such as principals and teachers. A total of 12 actor informants and 3 observer informants participated in the qualitative interviews. The characteristics of the actor informants are presented in Table 1, while the observer informants are presented in Table 2.

Data Collection

Surveys, in-depth interviews, observations, documentation, and literature reviews are used to collect quantitative and qualitative data. Collecting quantitative data involved questionnaire surveys on parental knowledge and behavior related to children's oral health, while qualitative data explored the socio-cultural factors influencing the previously identified knowledge and behavior in the quantitative findings.

Qualitative Data Collection

The qualitative data collection technique used semi-structured in-depth interviews. Participants were 12 parents and 3 representatives from PAUD HI institutions, purposively selected based on their

Table 1: List of Actor Informants

Kode	Age	Occupation	The Child's Dental Condition	School Name
P1	34	Homemaker	Caries-Free	Ar Risalah
P2				
P3	32	University lecturer	Dental Caries	
P4	33	Chief of Clinical Coordinator		
P5	52	University lecturer	Caries-Free	TK Islam Nibras
P6	33	Civil servant		
P7		University lecturer	Dental Caries	
P8		Principal		
P9	42	Homemaker	Caries-Free	TK IT Adzkia III
P10	36		Dental Caries	
P11	34			
P12	40		Dental Caries	

Table 2: List of Observer Informants

No	Name	Age	Position
1	If 1	38	Principal of Ra Ar Risalah
2	If 2	50	Vice Principal for Curriculum Affairs, Adzkie III
3	If 3	43	Principal of Nibras

willingness to participate and their ability to provide extensive information on children's oral health practices. The interview questions were created with consideration of the initial quantitative findings and relevant literature, in the form of open-ended questions.

All interviews were conducted face-to-face in a private setting. Each interview lasted approximately 30 to 60 minutes and was recorded in audio format with all participants' consent. Field notes of non-verbal observations that could not be retained in the audio were also taken during and right after each interview.

Ethical Considerations

All participants provided informed consent prior to data collection. Participation was entirely voluntary, and participants had the right to withdraw at any time without consequences. Identities of actor informants remained anonymous to ensure confidentiality and minimize potential bias and social judgment. Approval for this study was obtained from the Research Ethics Committee of the Faculty of Medicine, Universitas Andalas, Indonesia (Approval No. 264/UN.16.2/KEP-FK/2025).

Quantitative Data Analysis

This study used univariate, bivariate, and multivariate analyses to analyze the identified quantitative data. Univariate analysis helped to describe participants' characteristics and variable distributions. Bivariate and multivariate analyses, on the other hand, looked at the relationships and interactions between socio-cultural influences related to ECC risks.

Qualitative Data Analysis

Following the data collection phase is the transcription of the audio recording, word-for-word, to ensure the resulting analysis is thorough and accurate. The analysis was conducted using the interactive Miles and Huberman model, consisting of three steps: data reduction, data display, and conclusion drawing/verification.

After that, open coding was conducted to identify meaningful units of text related to the predetermined variables. Codes were organized into categories, and broader themes were subsequently developed after data interpretation. The final categorizations were first reviewed to make sure they accurately reflected participants' experiences and were supported by the data. Finally, the qualitative findings were systematically integrated during the analysis of the qualitative data.

Trustworthiness

Findings had greater credibility because of prolonged engagement with participants and extensive review of selected interview summaries. The data were validated through triangulation of parent and school representative perspectives. During the data collection and analysis, the researchers used detailed documentation to enhance the reliability of this study. Additionally, the researchers' team held regular discussions to ensure individual bias was as minimal as possible. Transferability was facilitated by providing detailed descriptions of the study setting, participants, and research context.

RESULTS

Quantitative Study Results

Dental caries is a condition characterized by structural changes in teeth due to poor oral hygiene. In children, parents and the environment play a huge role in shaping their dental condition, as children aged 1 to 6 years are still in a stage where they primarily depend on others. Since parents are children's first educators, they are chiefly responsible for fulfilling their children's needs, making this an obligation they must carry out.

Parental Knowledge and behavior Toward Children's Dental Condition

The quantitative study was conducted in August 2024 in six selected Early Childhood Education (PAUD) in Padang, West Sumatra. The objective was to analyze the factors that influence parental behavior

regarding their children's oral health monitoring. There were 258 parents (fathers and/or mothers) of early childhood children aged 1 to 6 who were enrolled in these institutions. Initially, questionnaires were distributed to 482 respondents either directly or online (Google Form). Not all responses were recorded until the final analysis. Following tabulation and data cleaning, 258 questionnaires were returned and fully completed by respondents, and these were subsequently included in the final analysis.

Table 3 shows that the respondents were predominantly female (mothers of early childhood children), accounting for 91.5%. Most respondents' last education level (72.5%) was higher education, including D3, D4, S1, S2, and S3 degrees. Regarding employment status, 93% of respondents were categorized as middle occupational status, primarily working in the sales/trade and service sectors. A total of 72.5% of respondents were classified as financially capable, with an income indicator of more than 3 million rupiah per month, and 91.5% had health insurance coverage. Concerning family dependents, 56.6% were in the moderate category, meaning they supported 4–6 family members.

The variable measuring parental knowledge of their children's oral health maintenance was predominantly at a good level, with the percentage of 98.8%. On the other hand, the variable assessing parental attitudes toward 'children's oral health monitoring showed 70.5%, also indicating a positive attitude. Not only from parents, but family support was reported as good by all respondents (100%), along with school support (88.8%). Additionally, support from health professionals was rated as good, with 79.5% of respondents rating it as good.

However, a little over half (55%) of the respondents agreed that primary (baby) tooth problems required no further treatment, and at the same time, that dental services were not affordable. In addition to this, all respondents (100%) reported having had negative experiences related to oral health problems. Exposure to information about early childhood oral health was predominantly perceived as low (53.5%), and access to oral health facilities was limited, with 73.6% of respondents reporting that such facilities were located more than 1 kilometer from their residence. Despite these findings, parental behavior was predominantly categorized as good, accounting for 94.2% of the total respondents.

None of the independent variables had a p-value less than 0.05, and there was no significant association between parental behavior and early childhood oral health maintenance. Furthermore, the Confidence Interval (CI) range of the Odds Ratio (OR) for each variable was 1, indicating that income, knowledge, attitude, beliefs, healthcare support, health information, and health facilities did not have statistically significant effects on parental behavior. Despite this, a minimum clinically meaningful OR value of 2 was found. Based on this finding, the independent variables considered to be having a clinical influence on the dependent variable (parental behavior) with OR values equal to or greater than 2 were: knowledge (OR = 8.607), attitude (OR = 2.207), support from health professionals (OR = 2.031), health information (OR = 2.512), and health facilities (OR = 5.33).

There were six determinant variables with p-value less than or equal to 0.25 ($p \leq 0.25$), which met the requirement for inclusion in the next multivariate analysis. These variables were knowledge, attitude, beliefs, support from health professionals, health information, and health facilities. These six variables were thus included in the multivariate logistic regression analysis, and backward stepwise variable selection was used.

Based on the results of the multivariate analysis, none of the independent variables tested in the logistic regression analysis had a p-value < 0.05 . Therefore, no independent variable was found to be statistically significantly associated with the dependent variable. After stepwise elimination using the backward stepwise method, no final regression model was obtained in this quantitative study. However, several independent variables demonstrated clinically meaningful Odds Ratio (OR) values greater than two, indicating that their potential influence on the dependent variable cannot be disregarded. These variables were knowledge (OR = 8.607), attitude (OR = 2.207), support from health professionals (OR = 2.031), health information (OR = 2.512), and health facilities (OR = 5.33).

After conducting quantitative analysis, the results showed that none of the determinant factor variables had a significant influence on parental behavior in maintaining young children's oral health. Following this was confirmation done through intraoral clinical examinations of 80 children whose parents were classified as having good behavior using the DMF-T index instrument, measuring caries experience based on the indicators of the number of decayed/carious

Table 3: Results of Univariate Analysis (Respondent Characteristics)

Variable determinant		II	%
Gender	Male	22	8.5
	Female	236	91.5
Health Insurance	None	23	8.3
	Present	235	91.5
Education	Base	8	3.1
	Middle	63	24.4
	High	187	72.5
Job	Low Status	15	5.8
	Current Status	240	93.0
	High Status	3	1.2
Income	Unable	71	27.5
	Able	187	72.5
Family Dependents	Small	105	40.7
	Currently	146	56.6
	Large	7	2.7
Knowledge to Maintain Oral Health	Less	3	1.2
	Good	255	98.8
Behavior of Maintaining Oral Health	Less	76	29.5
	Good	182	70.5
Belief in Maintaining Oral Health	Less	116	45
	Good	142	55
Dental Experience	Bad	258	100
	Good	0	0
Family Support	Bad	0	-
	Good	258	100
School Support	Bad	29	22.2
	Good	229	99.8
Healthcare Personnel Support	Bad	53	20.5
	Good	205	79.5
Health Information	Low Exposure	138	53.5
	High Exposure	120	46.5
Health Facility	Distance >1km	190	73.6
	Distance <1km	68	26.4
Behavior Of Maintaining Oral Health	Less	15	5.8
	Good	243	94.2

Table 4: Bivariate Analysis Results

Variable	Parental Behavior		
	P	OR	95% C.I.
Health Insurance	0,375	*	-
Education	0,768	*	-
Job	0,550	*	-
Income	1,000	0,955	0,294-3,104
Family Dependents	0,628	*	-
Knowledge	0,165	8,607	0,735-100,764
Attitude	0,132	2,207	0,771-6,318
Belief	0,230	0,425	0,132-1,373
Dental Experience	*	*	-
School Support	0,679	1,231	0,263-5,750
Healthcare Workforce Support	0,201	2,031	0,663-6,219
Health Information	0,186	2,512	0,778-8,107
Health Facilities	0,126	5,33	0,687-41,324

Table 5: Multivariate Analysis Results

Variable	Model 0		Model 1		Model 2		Model 3		Model 4		Model 5	
	p	OR	p	OR	p	OR	P	OR	p	OR	p	OR
Knowledge	0,120	9,878	0,094	11,372	0,072	12,422	0,075	10,647	0,77	10,435	-	-
Attitude	0,602	1,360	-	-	-	-	-	-	-	-	-	-
Belief	0,282	0,511	0,250	0,491	0,231	0,477	-	-	-	-	-	-
Healthcare Workforce Support	0,564	1,426	0,500	1,502	-	-	-	-	-	-	-	-
Health Information	0,325	1,864	0,265	1,990	0,222	2,109	0,176	2,275	-	-	-	-
Health Facility	0,157	4,493	0,150	4,620	0,141	4,802	0,117	5,327	0,101	5,649	0,109	5,330
Konstan	0,960	1,078	0,951	1,096	0,831	1,354	0,963	0,941	0,851	1,277	0,0001	12,571

teeth, the number of teeth extracted due to caries, and the number of filled teeth, with the results as follows: Table 6.

Table 6 shows that the average DMF-T score, a parameter of early childhood caries experience for children whose parents have good oral and oral health care practices, remains quite high at 7.48 ± 4.996 . This means that, on average, each child has approximately 7 to 8 cavities in their mouth, whether untreated, extracted, or filled. Nevertheless, the average number of extracted and filled teeth remains approximately 0 to 1 tooth per child. This data gap between parents who have demonstrated good behavior in maintaining early childhood oral and oral health and the average DMF-T score in children is an important reason to continue

research with a qualitative approach to explore factors that cannot be identified through quantitative research. Subsequently, qualitative analysis is used to examine the phenomenon in greater depth.

QUALITATIVE STUDY RESULTS

Parental Knowledge and behavior Toward Children's Oral Health

Good oral health occurs when adequate knowledge of oral health is acquired, and habits are consistently adopted in daily life. This, however, does not ensure alignment between knowledge and behavior, so progress does not always proceed as expected. Self-control was needed, which was influenced by the

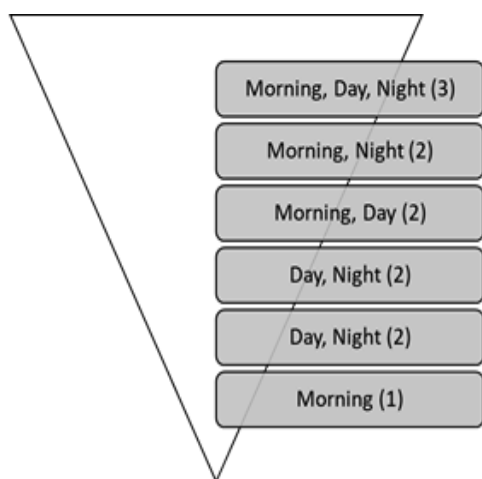
Table 6: Distribution of the Average dmft Score Among Early Childhood Students at TK Arrisalah, Padang

Indikator	n	Mean±SD	Min	Max
<i>decay</i> (Dental caries)	80	6,15±4,369	0	17
<i>missing</i> (Tooth extracted due to caries)		0,98±1,974		9
<i>filling</i> (Dental filling)		0,35±0,901		5
dmf-t		7,48±4,996		18

surrounding living environment. One example was parental knowledge of children's oral health and how such knowledge was implemented in the child's daily life. Family intervention was identified as the primary social institution in which children acquired knowledge. Based on the findings, several aspects of the informants' lives demonstrated that the socio-cultural context influences within families concerning children's oral health. These influences included habits related to the culture of toothbrushing within households and how children perceive dental care discipline imposed by their parents, whether it was traumatic or not. The following is an explanation of these factors:

The Culture of Tooth Brushing Within the Family

Parents' practices of cleaning their teeth were rooted in the idea that bathing was an important act that had to include brushing their teeth. With this idea, it was unusual for parents to measure how frequently the child brushed their teeth based on how often they took a bath. The timing was thus associated with bathing schedules, most commonly in the morning, when children begin their daily activities, such as going to school. Another common time was after children completed their daily activities, typically in the afternoon, after school activities were done.

**Figure 1: General Timeline for Cleaning Teeth.**

Source: Processed Results of the Author, 2025.

As illustrated above, the time schedules established by each family varied considerably, and this variation contributed to the continued prevalence of dental problems among young children. Mothers, who were generally responsible for childcare, tended to apply practices based on their own habits. Parents in Padang City commonly consider toothbrushing the most important practice for maintaining oral health. Generally, toothbrushing activity was closely tied to bathing routines. Parents perceived bath time as the easiest way to encourage children to brush their teeth and to build the habit. Although they understood that brushing teeth was important, in practice, it was almost exclusively associated with bathing rather than treated as a separate, structured oral health routine.

Emotional Attachment in Dental Care

Parents' influence was the most important factor on their children's oral health, as family was regarded as the primary institution through which children acquired knowledge. Parents' cultural backgrounds strongly influence their understanding and practices. In Padang City, although parents generally understood that sugary foods contributed significantly to dental problems, restrictions on their consumption were inconsistently enforced. Children were often allowed to consume sweet snacks, including milk products, chocolate, candy, and ice cream. In some cases, children may not get permission from parents, but their extended family might offer them sugary foods upon meeting.

Parenting style differences among family members might confuse children and, at the same time, allow them to negotiate their desires. Mothers, who tended to impose stricter limits on children's snack purchases, might find their rules undermined by fathers or other family members who applied more lenient controls. As a result, maternal restrictions were not absolute. Recognizing these dynamics within the family, often gravitated toward family members who were more permissive in order to fulfill their desire to purchase certain foods or snacks.

Traumatic Experiences Influencing Knowledge and Practice

There were regular check-ups and professional dental treatment by a dentist, as attempts to address children's dental situations. However, in Indonesia, particularly in Padang City, many parents primarily perceived dentists as places for treatment rather than preventive care, and children were typically taken to dental facilities only when problems had already occurred. This pattern has resulted in many children associating dental visits with pain and discomfort, leading to traumatic experiences related to healthcare facilities. Although parents might recognize that their children require further dental treatment, trauma experienced during previous visits could prevent follow-up care from being carried out. This condition was reinforced by one of the research informants, who stated that:

"She has a problem with supernumerary teeth inherited from her father. We wanted to extract them when she was younger, but we were afraid it might affect her nerves. So, I postponed it until she was 5 years old. After I took her to the public health center (puskesmas) once or twice, the service was not child-friendly, and it caused trauma for her. The dentist did not help her feel relaxed first, whereas she should have been made comfortable before the extraction. Then there was also Dr. Eca, who, together with the parents' guardian, tried to persuade her to have the tooth extracted. The approach even lasted up to two months, but in the end, the tooth was still not extracted."

Traumatic experiences can cause children to become less strict about following rules or, in some cases, even ignore them completely. In early childhood, trauma can significantly influence behavior, as children who are still in developmental stages are more vulnerable to psychological distress. When a child experiences trauma, parents may adjust their parenting approach so that they can accommodate their children's psychological condition while at the same time, making sure their dental condition remains healthy.

Control over Children's Food Consumption

Parents in Padang City generally recognized that sugary foods contributed to dental caries. Although

certain restrictions were placed on the consumption of sweet foods, in practice, parents still allow children to purchase them. The snacks most commonly bought by children included milk products, wafers, chocolate, ice cream, candy, and other similar sweet foods.

This permissiveness did not come only from parents but also from extended family members, such as aunts, uncles, and grandparents, who participated in caring for the children's health. Differences in caring styles among family members did not help further prevention but might confuse children and give them various options for acting on their wishes.

Children adapted to these dynamics by gravitating toward the more permissive caregivers, who gave them permission to consume sweet foods without restriction. Parents did have control over their children's food choices; however, this control weakened when parents were not physically present with the child, leading to reduced supervision. This situation was reinforced by one of the informants, who stated that:

"Nowadays, children's snacks are mostly sweet. My child likes milk, chocolate, and ice cream, so she has a slight cavity in her molars. She does like sweets, but we try to limit them, not everything, but almost every day, there is something. Sometimes she gets more from her father because when she is with me, I'm stricter. Her father is not as strict in limiting her snacks."

There were many situations in which children's consumption cannot be effectively controlled, such as when parents were busy working, when children threw tantrums, or when children were outside direct parental supervision. In some workplace environments, parents may fulfill children's requests for sweet foods to prevent tantrums. After consumption, oral hygiene practices were often not performed due to a lack of facilities or supervision. These conditions, taken together, increased the risk of dental caries among children in early childhood.

DISCUSSION

Behavioral as a Dominant Paradigm in Oral Health Research

Research on early childhood oral health has long been grounded in the behavioral factors as the main determinants, and preventive practices have become the primary solution. Since the mid-20th century, public

health research has been strongly influenced by positivist epidemiology and cognitive-behavioral models of the Health Belief Model and related social psychological theories [24]. Within this paradigm, health behavior is understood as a function of knowledge, perceived susceptibility, perceived severity, and access to enabling resources. Over time, these constructs have become standardized predictors in epidemiological and survey-based studies, even in those examining Early Childhood Caries (ECC).

In oral health research, several factors such as parental knowledge, attitudes, beliefs, informational exposure, socioeconomic background, and access to dental services are routinely operationalized as primary explanatory variables. With this analytical orientation, a broader rational-actor assumption is embedded in modern public health thinking, in which individuals are conceptualized as decision-makers who modify their behavior in response to information and perceived risk. Consequently, educational interventions, such as habit formation during school hours, have been widely promoted as an effective strategy to reduce ECC risks. The selection of quantitative variables in this study was based on this well-established analytical tradition and, therefore, aligned with the dominant explanatory approaches in the oral health literature.

However, the findings showed no statistically significant association between these cognitive determinants and parental oral health behavior. It raises questions because it may have marginalized another important factor: contextual limitations. The findings suggest that in socially embedded parenting environments such as PAUD HI settings in Padang, oral health practices may not be sufficiently explained through individual-level cognitive predictors alone. Rather than indicating methodological weakness, the results suggest that widely accepted behavioral determinants may operate differently across sociocultural contexts [25]. The observed gap between knowledge and practice signals a need to examine dimensions that extend beyond measurable cognitive variables.

Beyond Cognitive Determinism: Relational and Contextual Mediation of Practice

The qualitative findings indicated that parental oral health behavior was shaped by relational dynamics, emotional experiences, and educational arrangements, rather than solely by individual understanding. Although parents demonstrated relatively high levels of

knowledge regarding cariogenic foods and oral hygiene routines, the application of this knowledge was negotiated within the distribution of authority in the family [26]. Differences in tolerance among mothers, fathers, and other caregivers led to inconsistencies in regulating children's food consumption and hygiene practices [27]. Behavior, thus, did not function as a direct outcome of understanding alone, but as a social practice embedded within relational structures.

Emotional experiences further complicate the rational-actor assumption. The findings showed that children who have traumatic experiences going to the dentist or in oral healthcare facilities influenced parental decisions to delay or avoid preventive care, despite their being aware of its importance. Oral health behavior is then shaped not only by perceived risk but also by affective experiences embedded in children's memory [28]. Behavioral decisions arise from contextual situations rather than purely rational calculation. Such processes have been difficult to capture through standardized survey instruments that prioritize quantifiable cognitive variables [29].

Institutional dynamics of the PAUD HI system also contributed to the gap between knowledge and practice. Despite PAUD HI being designed as a holistic-integrative educational framework that incorporates healthy values, its integration into children's daily routines was inconsistent, particularly in eating practices in full-day settings. The eating habits have not always been accompanied by structured reinforcement of post-meal oral hygiene. As children spend a significant portion of their daily time at school, their oral health practices are influenced by both home and school environments. The absence of consistent institutional reinforcement further weakens the foundation built on parental habits at home, and thus, the sustainability of the behavior was not achieved.

Nutrition-Related Practices as Contextual Drivers of Early Childhood Oral Health

Qualitative interviews revealed that many parents were aware of the harmful effects of sugary foods but struggled to consistently regulate their children's consumption [30]. Parents frequently reported allowing children to consume sweet foods and beverages such as chocolate, candy, sweetened milk products, wafers, and ice cream. Feeding decisions were often influenced by multiple caregivers, not just parents. When grandparents and extended family members do not align with the children's parents' values, children may experience inconsistent dietary guidance.

The qualitative findings further demonstrated that dietary control became particularly challenging when parents were working, when children spent time with other caregivers, or when parents attempted to manage children's emotional responses such as tantrums. All these situations show how the distance between parents and children matters. Under these circumstances, sugary snacks were often used as rewards or as practical solutions to avoid conflict. Similar findings have been reported in previous studies in which feeding practices and family food environments significantly influence both nutritional status and oral health outcomes among young children.

These findings reinforce the growing recognition that Early Childhood Caries (ECC) should be viewed not only as an oral health problem but also as a nutrition-related condition. Frequent consumption of sugar-rich foods and inadequate post-consumption oral hygiene increase the risk of dental caries, while untreated caries may subsequently affect eating behavior, food intake, and overall child well-being. Therefore, oral health promotion programs should integrate nutrition education, healthy feeding practices, and family-based dietary management into comprehensive ECC prevention strategies [31].

Reconsidering behavioral Reductionism in Oral Health Interventions

Taken together, these findings contribute to broader discussions on behavioral reductionism in public health research. The dominance of cognitive determinants in oral health studies reflects a biomedical paradigm that prioritizes measurable individual risk factors over relational and contextual dynamics [32]. While this approach has generated valuable epidemiological insights, it may oversimplify complex social practices by reducing them to discrete variables [33]. Instead of rejecting cognitive-behavioral frameworks, this study's findings demonstrated the need to complement them with perspectives on socio-cultural context.

The persistence of ECC, even with relatively high parental knowledge levels, suggests that educational interventions alone may not fully address the structural and relational conditions shaping preventive behavior. In socially embedded parenting systems, particularly those characterized by distributed caregiving and extended family involvement, behavioral consistency depends on consistent permissiveness, attention to children's psychological state, and their attitude toward

dentists and dental problems, all of which are determined by family and school systems. Recognizing these dynamics helps us understand that ECC occurs not because of individual deficits, but rather because of interferences that can be addressed by embedding culture consistently within children's everyday social organization.

The present findings also have important implications for child health promotion programs. Interventions focused exclusively on increasing parental knowledge may be less effective if they do not address family feeding practices, children's dietary environments, and broader sociocultural influences. Integrated strategies involving parents, schools, health professionals, and extended family members may be more effective in reducing sugar consumption, improving oral hygiene practices, and promoting healthy child development. Such approaches are particularly relevant within PAUD HI settings, where health and nutrition promotion can be implemented simultaneously.

Study Limitations

This study was conducted in selected PAUD HI institutions in Padang City, providing insights that are particularly relevant to similar educational and sociocultural settings. The quantitative findings were based on parental self-reports, reflecting parents' perceptions and experiences of children's oral health practices. In addition, although nutrition-related behaviors emerged from the qualitative findings, direct dietary assessment was beyond the scope of the present study. Future research may benefit from incorporating objective dietary measures to further examine the relationships among feeding practices, nutrition, and oral health outcomes.

Nevertheless, a major strength of this study lies in the integration of quantitative and qualitative approaches, which enabled a comprehensive understanding of the socio-cultural, behavioral, and nutrition-related factors influencing early childhood oral health.

CONCLUSION

This mixed-methods study found that parental knowledge, attitudes, beliefs, and access to health services were not significantly associated with oral health practices among parents of young children in PAUD HI settings. The integration of quantitative and

qualitative findings revealed that children's oral health behaviors are influenced by broader socio-cultural factors, including family caregiving dynamics, emotional experiences, and daily parenting practices.

Importantly, nutrition-related factors such as frequent consumption of sugary foods, inconsistent dietary control among caregivers, and family feeding practices emerged as important contextual influences on early childhood oral health. These findings suggest that Early Childhood Caries should be addressed not only as an oral health problem but also as a child health and nutrition concern.

Public health interventions should therefore integrate oral health promotion with nutrition education, healthy feeding practices, caregiver involvement, and school-based preventive programs. Such integrated strategies may improve oral health outcomes and overall child well-being in early childhood.

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COMPETING INTERESTS

All the authors declare that there were no conflicts of interest.

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UNDERLYING DATA

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors of this study declare that no artificial intelligence (AI) tools or systems were used in any aspect of the study (study design, data collection and analysis, visualization, or the writing and editing

process). All work presented was conducted entirely by the authors.

The writing action and refinement, along with the text proofreading, were performed manually by a native English speaker, with no AI-based tools or language models to assist. The authors take full responsibility for the integrity and originality of the text.

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