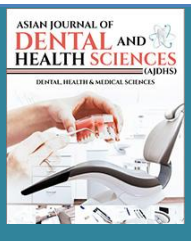

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Open Access Research Article

The Association Between Toothbrushing Knowledge and Toothbrushing Skills Among Preschool Children: A Cross-Sectional Study

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Abstract

Background: Poor oral hygiene remains a significant public health issue among preschool children, often attributed to inadequate oral health literacy and practice. Establishing effective toothbrushing habits early in life is critical, yet the direct relationship between what children know and how they perform remains to be fully elucidated. Objective: This study aimed to investigate the association between toothbrushing knowledge and toothbrushing skills among preschool children. Methods: A cross-sectional study was conducted involving 106 preschool children. Toothbrushing knowledge and practical toothbrushing skills were assessed using validated structured questionnaires and direct observation checklists, categorized into 'Good' and 'Less' levels. Data were analyzed using the Chi-square test with a significance level of $p < 0.05$. Results: The results revealed that the majority of respondents had less knowledge (77.4%) and less toothbrushing skills (65.1%). Among children with good knowledge (22.6%), 16.0% demonstrated good skills, while 6.6% showed less skills. Conversely, among children with less knowledge, 19.9% possessed good skills, and 58.5% exhibited less skills. Bivariate analysis demonstrated a highly significant association between toothbrushing knowledge and toothbrushing skills among preschool children ($p = 0.001$). Conclusion: There is a significant association between toothbrushing knowledge and toothbrushing skills in preschool children. Higher knowledge levels correspond to better practical skills, highlighting the urgent need for targeted oral health education and supervised brushing programs in early childhood settings to foster competent oral self-care habits.

Keywords: Toothbrushing knowledge, toothbrushing skills, preschool children, oral hygiene

INTRODUCTION

Early childhood represents a critical period for growth and development, during which the foundations for lifelong health behaviors are established. Among these, maintaining optimal oral health is paramount, as the primary dentition plays an essential role in speech development, proper mastication, and preserving space for permanent teeth.[1,2] In preschool children, oral health significantly impacts overall quality of life, influencing nutritional intake, sleep patterns, and psychological well-being. Dental caries and poor oral hygiene at this early stage can lead to chronic pain, premature tooth loss, and systemic complications, which can ultimately hinder a child's social growth and school readiness.[3,4] Therefore, instilling effective oral self-care habits, particularly correct toothbrushing practices, during the preschool years is crucial to preventing early childhood caries (ECC) and ensuring long-term dental health.

Despite its preventable nature, oral disease—specifically early childhood caries—remains a global public health crisis of significant magnitude. According to the World Health Organization (WHO), dental caries affects more than half of the preschool population worldwide, with disproportionately higher prevalence rates observed in developing countries and lower-socioeconomic communities.[5] Epidemiological data indicate that a vast majority of young children suffer from untreated dental decay, largely driven by high sugar consumption and poor dental plaque control.[6] In Indonesia, data shows an increase in the prevalence of active caries in the Indonesian population of 57.6%, while the prevalence of dental health in children aged 5-6 years is 92.6% with a def-t index of 8.43.[7] The latest results of the 2023 Indonesian Health Survey indicate that 84.9% of children aged 5 years have caries with a def-t index of 6.7.[8] This alarming magnitude of the problem underscores a widespread failure in daily oral hygiene compliance, where standard preventive measures are either neglected or improperly executed, necessitating a deeper evaluation of the factors that govern early childhood oral health practices.

The proficiency with which a preschool child brushes their teeth is influenced by a complex interplay of cognitive, behavioral, and environmental factors. Mechanically, toothbrushing requires advanced fine motor skills and manual dexterity, both of which are still developing in children aged three to six years.[9] Behaviorally, a child's skill level is closely tied to their

cognitive understanding and oral health literacy; children must comprehend the "how" and "why" of plaque removal to execute the task effectively. Furthermore, environmental reinforcement, such as parental supervision, socio-economic status, and regular dental health education, acts as a primary catalyst in transforming basic cognitive knowledge into habitual, high-quality physical skills.[10,11] Without a proper alignment of these factors, children frequently fail to reach the necessary threshold of efficiency required to maintain a disease-free oral cavity.

Numerous studies have explored the separate domains of oral health knowledge and practical behaviors in pediatric populations. Previous literature has consistently demonstrated that school-based oral health interventions and parental guidance can successfully increase children's theoretical knowledge regarding oral hygiene.[12] Scholars have documented that children who are exposed to interactive dental education programs show immediate improvements in their understanding of brushing frequencies and dietary habits.[13] However, historical research has predominantly focused on either evaluating parental knowledge or measuring the clinical plaque index of children, often viewing knowledge and practical skill as isolated variables rather than exploring the direct, interdependent mechanism that links a child's personal knowledge to their actual physical performance.

A significant research gap persists regarding the direct, quantitative correlation between a preschool child's independent oral health knowledge and their actual clinical toothbrushing skills. While it is widely assumed that increased knowledge automatically translates into improved behavioral habits, behavioral psychology suggests that a cognitive-behavioral gap frequently exists, where theoretical understanding does not guarantee functional mastery.[14] Most existing studies heavily rely on parental self-reports to measure children's habits, which are highly susceptible to social desirability bias, rather than utilizing direct, standardized clinical observation of the children's physical brushing techniques. Consequently, there is a scarcity of empirical evidence demonstrating how a preschool child's internal comprehension directly dictates their autonomous motor skills during oral cleaning.

This study is highly urgent because addressing this cognitive-behavioral gap is essential for designing effective, evidence-based oral health promotions that move beyond passive lecturing and focus on active skill acquisition. By investigating this relationship through direct observation, this study contributes valuable empirical data to the field of pediatric dentistry, offering a clearer framework for public health educators to develop targeted, interactive interventions. Ultimately, the objective of this cross-sectional study was to evaluate the direct association between toothbrushing knowledge and practical toothbrushing skills among preschool children, thereby providing a scientific basis for optimizing early childhood oral health strategies.

METHOD AND MATERIAL

This study employed an observational analytical, cross-sectional design to investigate the association between toothbrushing knowledge and practical toothbrushing skills among preschool children. Data collection for both variables was conducted simultaneously within a single period, ensuring an efficient assessment of the children's cognitive understanding and physical performance without temporary follow-up biases.[15]

This research was conducted at Mutiara Al Ikhlas Islamic Kindergarten and Musolla Iqra Islamic Kindergarten, South Jakarta, in April 2026. The target population consisted of preschool children aged 4 to 6 years who were actively enrolled in these institutions. The sampling technique used was total sampling, resulting in a sample size of 106 respondents.

The data collection instrument for knowledge about tooth brushing was measured using the Pictorial Oral Health Questionnaire modified from the study, which was designed for a pediatric population.[16] The use of pictures allows young children to easily identify correct dental care habits. Tooth brushing skills were measured using a standardized Direct Observation Checklist adapted from previous research. Data collection took place in a school setting. First, children were brought into a quiet classroom in small groups to complete a picture knowledge questionnaire, guided individually by a researcher who read the questions aloud. Second, children were taken sequentially through tooth-brushing practice.

Statistical analysis was conducted using descriptive statistics, including frequencies and percentages, were computed to summarize characteristics, knowledge levels, and skill categories. To test the hypothesis and assess the association between toothbrushing knowledge and toothbrushing skills, a Chi-square.

This study was approved by the Health Research Ethics Committee of the Yogyakarta Ministry of Health Polytechnic No.DP.04.03/e-KEPK.1/710/2026. Then administrative permissions were obtained from the heads of all participating preschools. Because the participants were minors, legal guardians provided signed written informed consent after receiving an explanatory sheet detailing the study's benefits and minimal risks. Children also gave verbal assent before any procedure commenced. To maintain strict confidentiality, all data sheets were anonymized using unique identification codes rather than personal names.

RESULT

Table 1: Frequency distribution of respondent characteristics

Respondent characteristics	Frequency	Persentage (%)
Age		
4 years	20	18.9
5 years	24	22.6
6 years	62	58.5
Gender		
Male	45	42.5
Female	61	57.5

Table 1 shows that most of the respondents were 6 years old and female.

Table 2: Frequency distribution of knowledge and toothbrushing skills

Variable	Frequency	Persentage (%)
Knowledge		
Good	24	22.6
Less	82	77.4
Toothbrushing Skills		
Good	37	44.9
Less	69	65.1

Table 2 shows that the majority of respondents have knowledge with the criteria of less and the majority of respondents have a less criteria of Toothbrushing Skills.

Table 3: Statistical test of the relationship between knowledge and toothbrushing Skills

No	Knowledge	Toothbrushing Skills				Total		*p-value*
		Good		Less				
		f	**%**	**f**	**%**	**f**	**%**	
1	Good	17	16.0	7	6.6	24	22.6	0.001
2	Less	20	19.9	62	58.5	82	77.4	
	Total	37	34.9	69	65.1	106	100	

Table 3 shows that the results showed that most respondents had less toothbrushing knowledge (77.4%) and less toothbrushing skills (65.1%). Among children with good knowledge (22.6%), 16.0% toothbrushing skills, while 6.6% exhibited less skills. In contrast, among children with less knowledge, 19.9% had good toothbrushing skills and 58.5% had less skills. Bivariate analysis revealed a statistically significant association between toothbrushing knowledge and toothbrushing skills among preschool children ($p < 0.001$).

DISCUSSION

The primary objective of this study was to evaluate the association between toothbrushing knowledge and practical toothbrushing skills among preschool children. The empirical results revealed a stark and highly significant statistical association between these two domains ($p = 0.001$). Interestingly, the descriptive data painted a concerning picture of the study population's baseline oral health literacy, showing that a vast majority of the children possessed less knowledge (77.4%) and less toothbrushing skills (65.1%). Among the children

who exhibited a poor grasp of oral health concepts, 58.5% also demonstrated deficient mechanical brushing skills. Conversely, higher proficiency was highly concentrated among those with superior understanding: 16.0% of the entire sample possessed both good knowledge and good skills. These findings clearly indicate that a preschool child's cognitive comprehension regarding oral hygiene does not exist in a vacuum but is directly mirrored in their physical capacity to execute plaque control.

This strong correlation can be interpreted through the lens of developmental cognitive and behavioral frameworks. In early childhood, behavior is heavily directed by immediate understanding and structural rules. When a child internalizes the correct concepts of oral hygiene—such as why certain surfaces must be brushed and the necessity of systematic stroke sequences—this cognitive architecture acts as a blueprint that guides their physical movements. Without this underlying knowledge, a child's toothbrushing attempt becomes a random, disorganized routine that misses critical anatomical areas like the lingual and posterior occlusal surfaces. The data clearly demonstrate that cognitive mastery is a vital precursor to physical competence, highlighting that children need to intellectually comprehend the task before they can physically master it.

Theologically and conceptually, these results strongly align with Bandura's Social Cognitive Theory, which argues that human behavior is developed through a triadic reciprocal interaction of cognitive factors, environmental influences, and behavioral execution.[17] In pediatric dentistry, knowledge serves as the cognitive component that directly enhances self-efficacy—the child's belief and internal capability to perform a task successfully. When children are taught the specific "how" and "why" of toothbrushing via visual or experiential methods, their internal self-efficacy increases. This cognitive empowerment optimizes their neuromotor control and attention span during the brushing process, effectively bridging the gap between passive reception of information and active behavioral mastery.[18,19]

The underlying explanation for the widespread deficiencies observed in this cohort—where 77.4% had less knowledge and 65.1% had less skills—can be traced back to the lack of structured, age-appropriate dental education in early childhood settings. At the age of 4 to 6 years, children are still developing their fine motor skills and manual dexterity, which are necessary to perform complex horizontal and vertical brushing strokes.[20] If they do not receive explicit, repetitive instruction that breaks down these movements into simple, memorable concepts, they will default to ineffective, superficial scrubbing. Furthermore, this widespread deficit indicates that standard parental modeling at home may be passive or uninstructed, failing to instill either the theoretical rationale or the proper mechanical technique required for thorough plaque removal.[21]

The implications of these findings are highly critical for public health policymakers, pediatric dental practitioners, and educators alike. First, because knowledge and skills are so heavily interdependent, future oral health programs must move away from traditional, passive lecture-style formats. Instead, they should adopt highly interactive, tactile, and experiential curriculums—such as using oversized dental models and song-timed activities—that simultaneously build theoretical knowledge and muscle memory. Second, since a significant portion of children still demonstrated deficient skills despite having good knowledge (6.6%), supervised toothbrushing programs in preschools must be mandated. Dental professionals must advocate for integrated school health policies where teachers and parents actively supervise daily brushing routines, ensuring that the child's cognitive understanding is continuously reinforced by accurate physical repetition until true competence is achieved.

CONCLUSION

Based on the research results, it can be concluded that the majority of preschool children had less toothbrushing knowledge and skills. A significant relationship was found between toothbrushing knowledge and toothbrushing skills, suggesting that improving children's knowledge may contribute to better toothbrushing practices.

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Conflict of Interest: The authors declare that they have no conflict interests.

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