# TOOTHBRUSHING KNOWLEDGE BEFORE AND AFTER HEALTH EDUCATION USING DENTAL PHANTOM AND AUDIOVISUAL MEDIA AMONG STUDENTS AGED 10–12 YEARS AT SDN 25 GADUT, AGAM REGENCY

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## Abstract

Proper toothbrushing knowledge is an important factor in maintaining oral health among school-aged children. Dental health education using appropriate media can improve students' understanding of proper toothbrushing techniques. This study aimed to describe students' toothbrushing knowledge before and after dental health education using phantom and audiovisual media among students aged 10–12 years at SDN 25 Gadut, Agam Regency. This descriptive study involved 98 students aged 10–12 years. Total population sampling was used. Data were collected using a questionnaire and analyzed descriptively using frequency distributions and percentages. Before education using the phantom medium, 26 students (53.1%) had moderate knowledge, 22 (44.9%) had good knowledge, and 1 (2.0%) had poor knowledge. After education, 44 students (89.8%) had good knowledge and 5 (10.2%) had moderate knowledge. Before education using audiovisual media, 27 students (55.2%) had moderate knowledge, 20 (40.8%) had good knowledge, and 2 (4.0%) had poor knowledge. After education, 41 students (83.7%) had good knowledge and 8 (16.3%) had moderate knowledge. In conclusion, dental health education using both phantom and audiovisual media was associated with an increase in the proportion of students with good toothbrushing knowledge. Descriptively, the phantom medium showed a greater increase in the proportion of students with good knowledge than the audiovisual medium. However, because the analysis was limited to frequencies and percentages, these findings do not establish statistical significance or confirm the superiority of either medium. Dental health professionals may consider using phantom media as an educational tool in school-based oral health promotion programs, while further studies using appropriate statistical analyses are needed to compare the effectiveness of these media.

Keywords: Knowledge, Toothbrushing, Phantom Media, Audiovisual Media, Elementary School Students

## 1. INTRODUCTION

Oral health is an important component of overall health and quality of life in children. Oral health problems, particularly dental caries, remain a major public health concern among school-aged children. Dental caries not only causes pain and impaired chewing function but can also affect children's ability to eat, sleep, learn, interact, and participate in daily activities optimally. The Global Oral Health Status Report published by the World Health Organization (WHO) indicates that oral diseases remain a global health problem that requires attention through promotive and preventive approaches, including strengthening health promotion in school settings [1].

In Indonesia, oral health problems also remain a significant concern. According to the 2018 Basic Health Research (Riskesdas), the proportion of the Indonesian population experiencing oral and dental problems reached 57.6%, while only 10.2% received dental care from dental health professionals. One of the major concerns is the low proportion of people who practice proper toothbrushing. The 2018 Riskesdas reported that only 2.8% of the population brushed their teeth correctly. This condition indicates that public knowledge and skills in maintaining oral health still need to be improved, particularly through promotive and preventive efforts beginning during school age [2].

Elementary school-aged children are a strategic target group for improving oral health because they are undergoing cognitive, motor, and social development, as well as the formation of health-related habits. Habits developed during the school years can serve as a foundation for health behaviors later in life. Therefore, schools provide a potential setting for implementing structured oral health education. WHO recommends school-based oral health promotion with key messages including brushing teeth twice a day for at least two minutes with fluoride toothpaste, maintaining a healthy diet, and having regular dental check-ups [3].

Toothbrushing is a simple, inexpensive, and effective measure for maintaining oral hygiene and helping to prevent dental caries. Regular use of fluoride toothpaste plays an important role in caries prevention. WHO recommends brushing teeth twice a day with toothpaste containing 1,000–1,500 ppm fluoride as part of daily self-care to prevent dental caries. However, the effectiveness of toothbrushing is determined not only by frequency but also by proper technique, duration, timing, and the ability to clean all tooth surfaces. Therefore, improving children's knowledge of proper toothbrushing techniques is an important component of oral health education [1].

Oral health education for children should employ methods and media that are appropriate to their developmental characteristics. Health information delivered solely through verbal explanations may be less engaging and more difficult to understand when it is not accompanied by examples or demonstrations. Elementary school children tend to understand information more easily when it is presented through direct experiences, concrete objects, pictures, sounds, movements, and demonstrations. Therefore, the use of appropriate educational media is expected to improve children's attention, comprehension, and ability to receive information related to oral health [4].

One medium that can be used for toothbrushing education is a dental phantom model. A dental phantom provides a three-dimensional representation of the shape and arrangement of teeth, allowing children to directly observe the areas that need to be cleaned. Through demonstrations using a dental phantom, health professionals can demonstrate toothbrushing movements systematically, including toothbrush positioning and the direction of movement, as well as cleaning the outer, inner, and chewing surfaces and areas around the gingival margins. The dental phantom also allows children to observe the movements directly and imitate them. This demonstration-based approach is relevant to skills-oriented learning because children receive not only verbal information but also visual and concrete learning experiences [4].

In addition to dental phantoms, technological developments have created opportunities to use audiovisual media in oral health education. Audiovisual media combine moving images, sound, text, and animation, allowing information to be delivered in a more engaging and multisensory manner. In the context of oral health education, audiovisual materials can present toothbrushing steps sequentially, enabling children to simultaneously see and hear explanations of proper toothbrushing techniques. The use of audiovisual media also allows information to be delivered consistently because the same material can be replayed as needed [4].

The use of educational media in oral health education has been supported by various studies. A systematic review of school-based oral health education among children aged 6–12 years showed that school-based oral health education can improve knowledge and oral health maintenance behaviors, including increased toothbrushing frequency and duration, increased use of fluoride toothpaste, and improvements in oral hygiene indicators. More recent research among elementary school children in Indonesia has also demonstrated that multimedia-based educational interventions can improve oral health knowledge, attitudes, and practices and contribute to positive changes in oral hygiene status [5].

Nevertheless, the effectiveness of educational media may vary depending on the characteristics of the target population, the method of delivery, the content, the duration of the intervention, and the level of children's involvement during the learning process. Dental phantoms and audiovisual media have different characteristics. A dental phantom provides a concrete learning experience through direct

demonstration using a dental model, whereas audiovisual media provide learning experiences through a combination of images, movement, sound, and systematically presented information. These differences may influence how effectively each medium supports children's understanding of proper toothbrushing [6].

The selection of appropriate educational media is increasingly important because oral health education in schools is not intended merely to provide information. It is also expected to improve children's understanding of why teeth need to be cleaned, when to brush their teeth, how long to brush, what tools and materials should be used, and how to perform proper toothbrushing techniques. With better knowledge, children are expected to have a stronger foundation for adopting and maintaining appropriate oral health behaviors in their daily lives [4].

Based on the above considerations, oral health education using appropriate educational media is an important strategy for improving toothbrushing knowledge among elementary school children. Dental phantom media provide a concrete learning experience through direct demonstration, whereas audiovisual media provide visual and auditory stimulation through a combination of images, movement, and sound. However, the use of these two media for improving toothbrushing knowledge among elementary school students warrants further investigation. Therefore, this study was conducted to describe toothbrushing knowledge before and after health education using dental phantom and audiovisual media among elementary school students. The findings are expected to provide a basis for selecting educational media that are appropriate, engaging, and suited to the characteristics of elementary school children, while supporting the implementation of promotive and preventive oral health programs in school settings.

## 2. METHODOLOGY

This study employed a quasi-experimental pretest–posttest two-group design to describe changes in toothbrushing knowledge among students aged 10–12 years following dental health education using dental phantom and audiovisual media at SDN 25 Gadut, Agam Regency. Knowledge was assessed using a structured questionnaire administered before (pretest) and after (posttest) the educational intervention. Group I comprised 49 students who received education using a dental phantom, while Group II comprised 49 students who received education using audiovisual media. The groups were assigned before the intervention without randomization.

The study population consisted of all 98 students aged 10–12 years enrolled at SDN 25 Gadut. Total population sampling was employed, with all eligible students included as respondents. The inclusion criteria were students aged 10–12 years enrolled at the school, able to understand the instructions and complete the questionnaire, and participating with parental consent and student assent. The exclusion criteria were students who were absent during the intervention or had incomplete questionnaires. Students with cognitive or communication limitations that prevented them from completing the questionnaire were also excluded, if applicable.

Data were analyzed descriptively using frequency distributions and percentages to summarize students' knowledge levels before and after the intervention in each group. No inferential statistical tests were conducted; therefore, the findings were interpreted descriptively and did not establish statistical significance or the superiority of either educational medium.

The research instrument was a toothbrushing knowledge questionnaire covering the definition and purpose of toothbrushing, appropriate toothbrushing times, frequency of toothbrushing, selection of toothbrushes and toothpaste, the appropriate amount of toothpaste, toothbrushing techniques, areas of the teeth and oral cavity that should be cleaned, and toothbrush maintenance. The questionnaire consisted of closed-ended questions with predetermined answer choices. Each correct answer was assigned a score of 1, while an incorrect answer was assigned a score of 0. The total score obtained by each respondent was then calculated to determine their level of knowledge.

Data collection was conducted in several stages. First, coordination was established with the administration of SDN 25 Gadut, Agam Regency, and the objectives and procedures of the study were explained. The respondents were then informed about the research activities and asked to complete an initial questionnaire (pretest) to assess their knowledge before the health education intervention. Following the pretest, the 98 respondents were divided into two groups, each consisting of 49 students.

Group I received health education on proper toothbrushing techniques using a dental phantom, namely a model of the teeth and oral cavity used to demonstrate toothbrushing techniques directly. Group II received the same educational material using audiovisual media in the form of a video or visual presentation containing information and demonstrations of proper toothbrushing techniques. The educational content and duration were kept relatively similar between the two groups.

After the health education sessions were completed, both groups were given the same questionnaire again as a posttest to assess their knowledge after receiving the intervention. The pretest and posttest data were subsequently checked for completeness, coded, processed, and analyzed according to the objectives of the study.

Data were analyzed using univariate analysis to describe respondent characteristics and the distribution of toothbrushing knowledge before and after te health education intervention. Knowledge scores were presented as frequencies and percentages. Knowledge levels were categorized according to the percentage of scores obtained by each respondent as follows: good (76–100%), moderate (56–75%), and poor (≤55%).

Participation in the study was voluntary. Parental consent and student assent were obtained before data collection, where applicable. Respondents' information was handled confidentially and used solely for research purposes.

## 3. RESULTS

### 3.1 Frequency Distribution of Students' Toothbrushing Knowledge Before and After Health Education Using Dental Phantom Media

***Table 1****. Frequency Distribution of Toothbrushing Knowledge Before and After Health Education Using Dental Phantom Media Among Students Aged 10–12 Years at SDN 25 Gadut, Agam Regency*

| Knowledge Level | **Before Health Education** | | **After Health Education** | |
|---|---|---|---|---|
| | f | % | f | % |
| Good | 22 | 44,9 | 44 | 89,8 |
| Moderate | 26 | 53,1 | 5 | 10,2 |
| Poor | 1 | 2,0 | 0 | 0 |
| Total | 49 | 100 | 49 | 100 |

The results showed that before receiving health education using dental phantom media, the respondents' level of knowledge regarding proper toothbrushing was not yet optimal. Of the 49 respondents, 22 (44.8%) had a good level of knowledge, 26 (53.2%) had a moderate level of knowledge, and 1 (2.0%) had a poor level of knowledge. The predominance of the moderate knowledge category before the intervention indicates that most respondents had basic knowledge about toothbrushing, but their understanding was not yet fully adequate. This condition highlights the importance of providing oral health education supported by learning media appropriate to the characteristics of school-aged children. Oral health education is one of the strategies that can be used to improve children's knowledge and understanding of oral health maintenance, including proper toothbrushing techniques [7,8].

After receiving health education using dental phantom media, a change was observed in the distribution of the respondents' knowledge levels. The number of respondents with a good level of knowledge increased from 22 (44.8%) to 44 (89.8%), while 5 respondents (10.2%) remained in the moderate category, and no respondents were classified as having poor knowledge. Descriptively, these findings indicate an increase in the proportion of respondents with good knowledge after receiving health education using dental phantom media. This change suggests that information regarding proper toothbrushing techniques may have been better received after the respondents participated in health education using a medium that allowed the material to be presented in a concrete and easily observable manner [8,9].

The increase in knowledge observed in this study may be associated with the use of a dental phantom as an educational aid during the health education process. A dental phantom allows educators to directly demonstrate the different parts of the teeth and proper toothbrushing movements. Thus, respondents receive information not only through verbal explanations but also through observation of objects and demonstrations. The use of demonstration methods provides participants with an opportunity to observe the process directly, making the material more concrete and easier to understand. A study by Anwar and Zulkifli among children aged 10–12 years also demonstrated an increase in toothbrushing knowledge after education was provided through a demonstration method using a dental phantom [8].

The findings of this study are also consistent with those of Aritonang and Purba, who compared oral health education using poster and dental phantom media among elementary school students. Their study showed that the use of a dental phantom resulted in 75% of students having a good level of knowledge, while 16.7% had a moderate level and 8.3% had a poor level of knowledge. These findings indicate that a dental phantom can be used as a teaching aid in toothbrushing education because it provides a more concrete representation than information presented through two-dimensional visual media [10]. These findings support the results of the present study, in which the proportion of respondents with good knowledge increased after receiving health education using a dental phantom.

The results of this study are also consistent with those of Gonie, Wowor, and Mariati, who reported that dental health education using a demonstration method with a dental phantom was effective in improving toothbrushing knowledge among elementary school students. Their study used a pretest–posttest design and demonstrated increased knowledge following oral health education accompanied by a demonstration [11]. Similarly, Sulistiani and Hanum reported that health education using a lecture method combined with demonstrations improved toothbrushing knowledge among elementary school children, as indicated by an increase in the mean knowledge score after the intervention [12]. The consistency of these findings suggests that presenting toothbrushing information using a dental phantom can help students understand the material more effectively.

From a pedagogical perspective, the use of a dental phantom in toothbrushing education provides a more concrete learning experience because respondents can directly observe tooth positioning, the direction of brushing movements, and the areas of the teeth that need to be cleaned. School-aged children generally benefit from clear and observable examples so that the information provided can be understood and remembered more easily. Therefore, dental phantom media can serve as an alternative medium for oral health promotion in schools, particularly for educational content related to toothbrushing skills. Studies by Aritonang and Purba, as well as studies on demonstration methods among elementary school children, indicate that the use of teaching aids and demonstrations can support improvements in knowledge regarding proper toothbrushing techniques [8,11].

The increase from 22 respondents (44.8%) with good knowledge before the intervention to 44 respondents (89.8%) after the intervention demonstrates a clear descriptive change in the distribution of knowledge. In addition, the absence of respondents in the poor knowledge category after the intervention indicates that all respondents had achieved at least a moderate level of knowledge. These findings provide a descriptive indication that health education using dental phantom media may help improve children’s understanding of proper toothbrushing techniques [8,9,12].

Based on these findings, dental phantom media may be considered as one of the media options for oral health promotion activities in elementary schools. This medium can support interactive health education because it allows educators to demonstrate toothbrushing techniques directly and enables respondents to observe the steps being explained. Thus, the use of dental phantom media not only facilitates the delivery of information but may also support a more concrete learning process in oral health education for elementary school children [7,9,11].

### 3.2 Frequency Distribution of Students' Toothbrushing Knowledge Before and After Health Education Using Audiovisual Media

***Table 2**. Frequency Distribution of Toothbrushing Knowledge Before and After Health Education Using Audiovisual Media Among Students Aged 10–12 Years at SDN 25 Gadut, Agam Regency*

| Knowledge level | Before Health Education | | After Health Education | |
|---|---|---|---|---|
| | f | % | f | % |
| Good | 20 | 40,8 | 41 | 83,7 |
| Moderate | 27 | 55,2 | 8 | 16,3 |
| Poor | 2 | 4,0 | 0 | 0 |
| Total | 49 | 100 | 49 | 100 |

The findings showed an improvement in students' tooth-brushing knowledge following health education using audiovisual media. The proportion of students with good knowledge increased from 22 (44.8%) before the intervention to 44 (89.8%) afterward, representing a 45.0 percentage-point increase. Meanwhile, the proportion with moderate knowledge decreased from 53.2% to 10.2%, and no students remained in the poor knowledge category. These descriptive findings indicate a shift toward a higher level of knowledge following the educational intervention.

The improvement in knowledge following education using dental phantom media may be explained by its practical and demonstrative characteristics, which allow students to observe tooth-brushing techniques directly. Dental phantoms provide a concrete representation of oral structures and brushing movements, helping students understand the correct technique. This approach is particularly useful for educational material involving practical skills. Learning media that provide concrete experiences can facilitate students' understanding of educational content [16,17]. However, the effectiveness of phantom media should also be considered in relation to students' baseline knowledge and the educational methods used.

Similarly, the improvement following audiovisual education may be associated with the combination of visual and auditory stimuli provided through animated videos, moving images, and verbal explanations. These features can attract students' attention and help them understand information about tooth-brushing frequency, timing, toothpaste use, and proper brushing techniques. Previous studies by Jelita et al., Haloho et al., and Prasko et al. reported improvements in children's tooth-brushing knowledge following audiovisual or animated-video education [14,17,18]. A systematic review by Daulay and Pakpahan also supported the use of visual and audiovisual media in oral health education for elementary school children [6].

Both phantom and audiovisual media can support oral health education through different learning approaches. Phantom media provide direct demonstrations of tooth-brushing techniques, whereas audiovisual media combine visual and auditory stimuli to present educational information. Harapan et al. reported that animated video media produced a greater improvement in tooth-brushing knowledge than dental phantom media in their study [15]. In the present study, the comparison between the two media was based on descriptive changes in students' knowledge distributions. Therefore, the findings can describe the patterns of knowledge improvement associated with each medium but cannot establish statistical differences or determine the superiority of one medium over the other.

These findings highlight the potential of both phantom and audiovisual media as educational tools for promoting oral and dental health among elementary school students. Selecting media that match children's learning characteristics and the educational objectives may improve the delivery and understanding of health messages [6,13,16]. Dental phantoms may be particularly useful for demonstrating brushing movements, while audiovisual media can support the presentation of information in an engaging and accessible format. Combining the two approaches may also be considered to support both conceptual understanding and practical learning.

This study has limitations. The analysis was based on frequency distributions and percentages without statistical testing; therefore, the observed changes in students' knowledge can only be

interpreted descriptively and cannot be considered statistically significant differences. Furthermore, the study assessed knowledge rather than actual tooth-brushing practices or long-term behavioral changes. Future studies should incorporate appropriate statistical analyses, evaluate practical tooth-brushing skills, and include follow-up assessments to examine the sustainability of knowledge improvement.

## 4. CONCLUSIONS

Based on the findings of this study, it can be concluded that there was an increase in students' knowledge of tooth brushing after health education was provided using both phantom and audiovisual media. Descriptively, both educational media, namely dental phantom and audiovisual media, demonstrated a shift in students' knowledge levels toward a better category. The increase in the proportion of students with good knowledge by 45.0 percentage points in the phantom group and 42.9 percentage points in the audiovisual group indicates that both media can be used as educational tools to improve students' knowledge regarding tooth brushing.

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