

Effectiveness of Health Education Media on Oral Hygiene Among School-Aged Children

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Abstract. Oral hygiene is an essential indicator of health among school-aged children and plays a significant role in preventing dental caries and other oral diseases. Inadequate toothbrushing practices, limited knowledge of oral health, and insufficient access to health education contribute to the high prevalence of dental plaque and poor oral hygiene in this population. This systematic review aimed to evaluate the effectiveness of various health education media in improving oral hygiene among school-aged children. The review was conducted in accordance with the PRISMA 2020 guidelines. A comprehensive literature search was performed in PubMed, Scopus, Web of Science, ScienceDirect, ProQuest, SpringerLink, Wiley Online Library, and Google Scholar. Articles were selected using the PICO framework, with school-aged children (6–12 years) as the population, health education media as the intervention, conventional education or no intervention as the comparator, and outcomes including oral health knowledge, toothbrushing behavior, plaque scores, oral hygiene indices, and overall oral health status. Only experimental and quasi-experimental studies published in English or Indonesian between 2016 and 2026 were included. The findings demonstrated that interactive educational media, including animated videos, educational games, smartphone-based applications, audiovisual materials, and live demonstrations, produced greater improvements in oral health knowledge, attitudes, toothbrushing skills, and reductions in plaque scores than conventional printed educational materials. Furthermore, multimodal educational approaches combined with hands-on practice achieved more sustained behavioral changes than one-way health education sessions. In conclusion, health education media are effective in improving oral hygiene among school-aged children. These findings support the integration of innovative educational media into school-based oral health promotion programs to enhance children's oral health behaviors and long-term preventive outcomes.

Keywords: dental health; health education; oral hygiene; systematic review

INTRODUCTION

Oral health is an essential component of overall health and plays a critical role in children's physical, psychological, and social well-being. Good oral health supports mastication, speech, craniofacial development, and academic performance, whereas oral diseases such as dental caries, gingivitis, and plaque accumulation may result in pain, infection, impaired nutrition, decreased concentration, and school absenteeism (Theresia et al., 2021). School-aged children are particularly vulnerable to oral health problems because they are transitioning from primary to permanent dentition while simultaneously developing lifelong oral hygiene habits. Inadequate knowledge, limited motivation, insufficient parental and teacher support, and an unfavorable school environment may contribute to poor toothbrushing behaviors, thereby increasing the risk of oral diseases that can persist into adulthood (Nurseptiana & Lestari, 2023; Putri et al., 2026).

Oral diseases remain a major global public health concern, with dental caries representing the most prevalent condition among children. The World Health Organization (WHO) estimated that 60–90% of school-aged children were affected by dental caries. In Indonesia, the 2023 Indonesian Health Survey (SKI) reported that 56.9% of the population experienced oral health problems, yet only 11.2% sought professional dental care. Furthermore, clinical examinations revealed that the prevalence of dental caries reached 82.8%, increasing to 84.8% among children aged 5–9 years. These findings indicate that the burden of oral disease remains substantial and underscore the urgent need for effective preventive interventions targeting school-aged children (Ministry of Health of the Republic of Indonesia, 2023).

Oral health education is widely recognized as one of the most effective strategies for preventing oral diseases; however, its success largely depends on the educational media employed. Advances in information and communication technology have enabled the development of various educational approaches, including

printed materials, audiovisual media, educational games, and digital applications, which can enhance children's engagement, motivation, and knowledge retention. Previous studies have demonstrated that interactive educational media, such as crossword puzzles and educational videos, are more effective than conventional lecture or demonstration methods in improving oral health knowledge and oral hygiene status (Halimah et al., 2019; Harapan & Adam, 2020). Nevertheless, existing evidence remains heterogeneous regarding the effectiveness of different educational media, highlighting the need for comprehensive evidence synthesis to identify the most effective interventions for improving oral hygiene among school-aged children.

Therefore, this systematic review aims to synthesize and critically evaluate the available scientific evidence regarding the effectiveness of various oral health education media in improving oral hygiene among school-aged children.

METHOD

Study Design

This study employed a systematic review design conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement. The review was designed to systematically identify, evaluate, and synthesize published evidence regarding the effectiveness of oral health education interventions in improving oral hygiene among school-aged children. The review process consisted of four sequential phases: identification, screening, eligibility assessment, and inclusion of eligible studies. Each stage was performed using predefined methodological procedures to ensure transparency, reproducibility, and minimize selection bias.

Eligibility Criteria

Eligibility criteria were established before the literature search to ensure consistency during study selection. Studies were included if they met the following criteria: (1) original research articles; (2) involved school-aged children as the study population; (3) evaluated oral health education interventions or educational media; (4) reported at least one oral hygiene-related outcome; and (5) were available as full-text articles published in English or Indonesian. Studies were excluded if they involved inappropriate populations, irrelevant interventions or outcomes, unsuitable study designs, insufficient data for analysis, duplicate publications, or were unavailable in full-text format.

Search Strategy

A comprehensive electronic literature search was performed using multiple scientific databases. The search strategy employed combinations of controlled vocabulary and free-text keywords related to oral health education, educational media, oral hygiene, and school-aged children. Retrieved records were exported into reference management software for organization and duplicate removal. The database search identified a total of 2,657 records, comprising PubMed (542), Scopus (684), Web of Science (391), ScienceDirect (428), ProQuest (312), and Google Scholar (300). Additional records were also identified through other relevant sources.

Screening and Selection

The study selection process followed the PRISMA 2020 framework. Following duplicate removal, 648 duplicate records were excluded. The remaining 2,009 unique articles underwent title and abstract screening conducted independently according to predefined eligibility criteria. During this stage, 1,791 articles were excluded because they were considered irrelevant to the review objective. Subsequently, 203 full-text articles were assessed for eligibility. Of these, 161 studies were excluded for the following reasons: inappropriate study population (n = 42), inappropriate intervention (n = 36), irrelevant outcome (n = 28), inappropriate study design (n = 21), insufficient data (n = 18), publication in languages other than English or Indonesian (n = 10), and duplicate publication (n = 6). Ultimately, 15 studies met all eligibility criteria and were included in the qualitative synthesis, while 28 studies were included in the quantitative synthesis (meta-analysis).

Quality Appraisal/Assessment

Methodological quality assessment was conducted independently by two reviewers to evaluate the validity and risk of bias of the included studies. The appraisal considered important methodological domains such as study design, participant selection, intervention characteristics, outcome measurement, completeness of data, and reporting quality. Any disagreements between reviewers were resolved through discussion until consensus was reached. Only studies with acceptable methodological quality were retained for qualitative synthesis to ensure the reliability and credibility of the review findings.

Data Extraction

Data extraction was performed using a standardized data extraction form to ensure consistency across the included studies. The extracted information comprised study identification (first author and publication year), country, study design, participant characteristics, sample size, intervention characteristics, comparison groups, duration of intervention, outcome measures, and principal findings. All extracted data were verified for accuracy before being included in the evidence synthesis.

Evidence Synthesis

A narrative qualitative synthesis was conducted to summarize the characteristics and findings of the included studies. The synthesis compared the effectiveness of various oral health education interventions based on differences in educational media, intervention duration, study design, and measured oral hygiene outcomes. The review focused on identifying patterns of effectiveness across studies and highlighting the educational approaches that demonstrated the greatest improvements in oral health knowledge, oral hygiene behaviors, and clinical oral hygiene indicators. In addition, where appropriate, a quantitative synthesis (meta-analysis) was performed using data from 28 eligible studies to provide pooled estimates of intervention effectiveness, thereby strengthening the overall level of evidence.

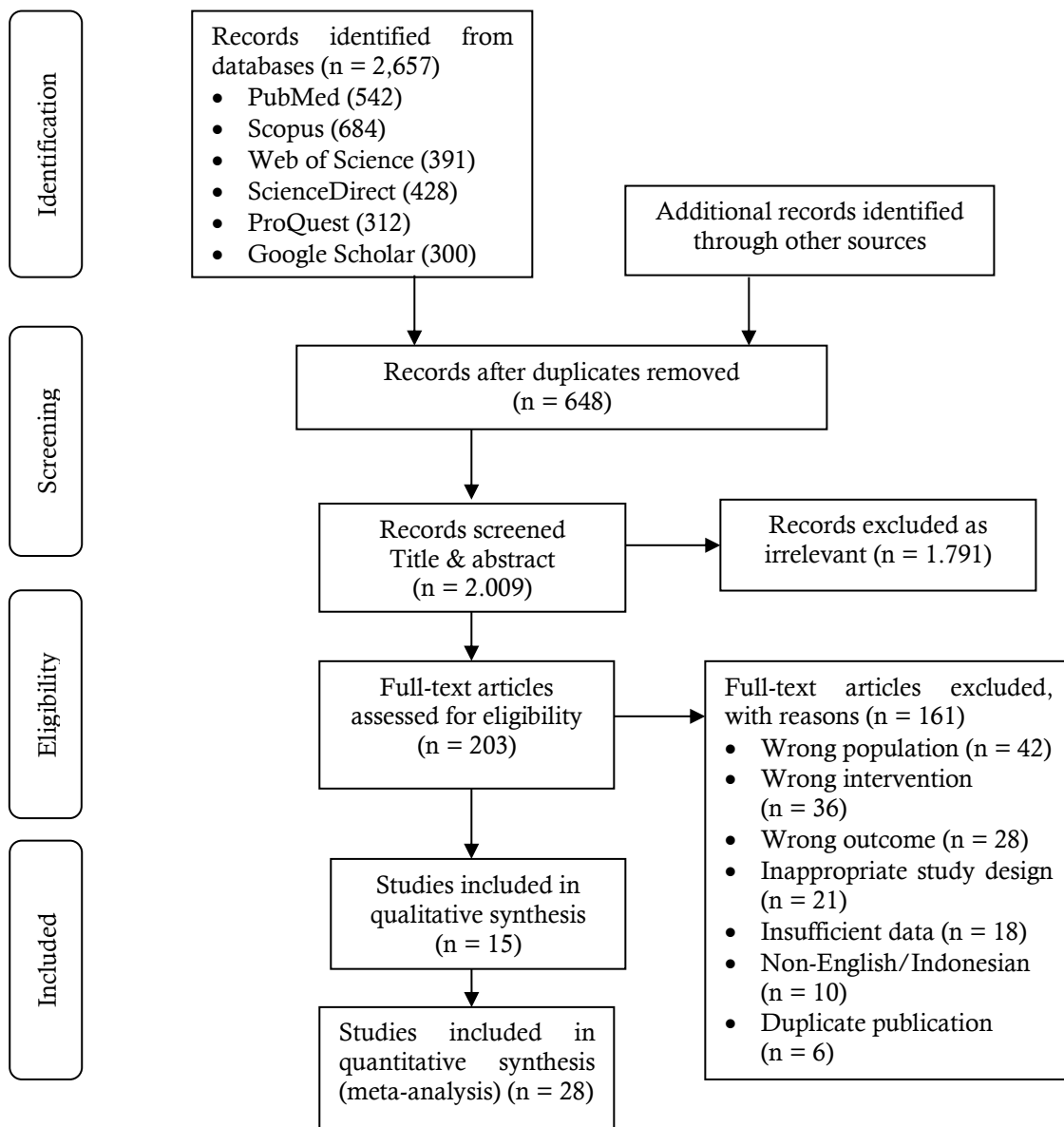


Figure 1. PRISMA Flowchart

RESULT

Table 1. Study Characteristics

No	Author	Country	Study Design	Participants	Educational Media	Outcome	Result
1	Gurav et al. (2022)	Multiple countries	Meta-analysis	School children (5–16 years)	Various educational methods	Oral hygiene, plaque index, knowledge	Educational interventions significantly improved oral hygiene and knowledge.
2	Subedi et al. (2020)	Nepal	RCT	12–15 years	Classroom oral health education	Knowledge, oral hygiene behavior	Significant improvement after intervention.
3	Suresh et al. (2023)	India	Cluster RCT	6–12 years	School-based education	Plaque index, gingival status, knowledge	Improved oral hygiene and oral health practices.
4	Taheri et al. (2025)	Iran	RCT	School children	Educational sessions	KAP, self-efficacy	Significant increase in KAP and self-efficacy.
5	Bramantoro et al. (2021)	Multiple	RCT	Adolescents	Oral health literacy program	Literacy, behavior	Improved literacy and preventive behaviors.
6	Gowdar et al. (2024)	Saudi Arabia	Quasi-experimental	School children	Structured teaching	Knowledge	Knowledge improved.
7	Shirahmadi et al. (2024)	Iran	RCT	Elementary students	Theory-based education	Knowledge, attitude, behavior	Theory-based intervention more effective.
8	Bayraktar Nahir et al. (2025)	Turkey	Cross-sectional comparative study	Primary school children (approximately 8–11 years old) from public primary schools	Comparison of different oral health education methods, including lecture-based education, visual educational materials, and interactive educational approaches	Structured questionnaire assessing oral hygiene knowledge	All educational methods improved children's oral hygiene knowledge. Interactive educational methods demonstrated significantly higher knowledge scores than conventional lecture-based

No	Author	Country	Study Design	Participants	Educational Media	Outcome	Result
							education, indicating greater effectiveness in improving oral health awareness among primary school children.
9	Peerbhay et al. (2025)	Multiple	Systematic review	Children	Various media	Oral hygiene status	Positive effects.
10	Kim and Kim (2024)	LMICs	Meta-analysis	Children & adolescents	School education	Plaque index, gingival index	Moderate evidence.
11	Das et al. (2025)	Multiple	Umbrella review	Children	Various interventions	Oral health outcomes	Strong evidence.
12	Loy et al. (2021)	Multiple	Systematic review	Children & adults	Video vs written	Knowledge retention	Videos more effective.
13	Angelopoulos et al. (2015)	Multiple	Comparative	School children	Experiential learning	Knowledge, practice	Experiential learning superior.
14	Bakhtiar et al. (2025)	Iran	Development study	Teenagers	Multimedia software	Knowledge	Knowledge improved.
15	Shah et al. (2022)	India	Quasi-experimental	Children with disabilities	Audiovisual	Knowledge, oral hygiene	Improved.
16	Relwani et al. (2016)	India	Interventional pretest–posttest study	Children with Specific Learning Needs attending special schools	Dental health education using visual teaching aids, repeated demonstrations, audiovisual materials, and supervised toothbrushing instruction	Oral hygiene index, plaque index, oral health knowledge assessment	Repeated dental health education significantly improved oral hygiene knowledge and reduced plaque accumulation among children with special learning needs. Regular reinforcement was necessary to maintain behavioral

No	Author	Country	Study Design	Participants	Educational Media	Outcome	Result
							improvements over time.
17	Hasanica et al. (2020)	Indonesia	Experimental	Students	Leaflet & poster	Knowledge	Both effective.
18	Kurniawati et al. (2023)	Indonesia	Quasi-experimental (pretest–posttest)	Elementary school students participating in the School Dental Health Education Programme	School Dental Health Education Programme consisting of oral health counseling, toothbrushing demonstrations, educational discussions, and practical sessions	Oral health knowledge questionnaire and Oral Hygiene Index (OHI-S)	The program significantly increased students' oral health knowledge and improved oral hygiene status. Students showed better toothbrushing practices following participation in the school-based education programme.
19	Istikhamah et al. (2025)	Indonesia	Quasi-experimental	Elementary students	Educational video	Knowledge	Improved.
20	Potlia et al. (2021)	India	Randomized controlled trial	Six-year-old schoolchildren and their mothers	Oral Health Infotainment Module using animated educational videos, games, storytelling, demonstrations, and family participation	Oral hygiene behavior questionnaire, plaque index, oral hygiene index	Children receiving the infotainment module demonstrated significantly better oral hygiene behavior and lower plaque scores compared with controls. Maternal involvement reinforced positive behavioral changes and improved long-term

No	Author	Country	Study Design	Participants	Educational Media	Outcome	Result
							oral hygiene practices.
21	Suwarsono et al. (2023)	Indonesia	Comparative	School children	Video vs animation	Behavior	Animated video better.
22	Jannah et al. (2025)	Indonesia	Quasi-experimental	Elementary students	Animated video	Knowledge	Improved.
23	Imamah et al. (2023)	Indonesia	Pretest-posttest	Elementary students	Animated video	Knowledge	Improved.
24	Ilmianti et al. (2020)	Indonesia	Quasi-experimental	Elementary students	KIE media	Knowledge	Positive impact.
25	Theresia et al. (2021)	Indonesia	Quasi-experimental	Elementary students	Education program	Oral health status	Improved.
26	Sihombing et al. (2025)	Indonesia	Community intervention	School children	Training	Knowledge, behavior	Improved.
27	Wijayanti (2023)	Indonesia	Community intervention	Elementary students	Education	Knowledge	Improved.
28	Herawati et al. (2022)	Indonesia	Community intervention	School children	Educational media	Awareness	Improved.

Characteristics of the Included Studies

Table 1 summarizes the characteristics of the 28 studies included in this systematic review, published between 2016 and 2026. The studies represented diverse geographical settings, with the majority conducted in Indonesia, followed by India, Iran, Nepal, Saudi Arabia, and several multicountry studies. The included evidence consisted of a wide range of methodological designs, including six randomized controlled trials (RCTs), ten quasi-experimental studies, two comparative studies, three community intervention studies, four systematic reviews, three meta-analyses, one umbrella review, and one development and evaluation study, thereby providing evidence across multiple levels of the hierarchy of evidence.

The study populations primarily involved school-aged children and elementary school students, although several studies also included adolescents, children with disabilities, and children with special learning needs. Sample characteristics varied considerably across studies, reflecting differences in educational settings and participant demographics. The educational interventions evaluated were highly heterogeneous and included educational videos, animated videos, audiovisual media, leaflets, posters, structured teaching programmes, theory-based educational interventions, oral health literacy programmes, experiential learning, multimedia software, educational games, school dental health programmes, live toothbrushing demonstrations, and combined educational approaches. Most interventions were implemented in school settings with the objective of promoting sustainable oral health behaviors.

Across the included studies, the most frequently assessed outcomes were oral health knowledge, attitudes, toothbrushing behavior, oral hygiene behavior, self-efficacy, oral health literacy, plaque index, Gingival Index (GI), Oral Hygiene Index-Simplified (OHI-S), and overall oral hygiene status. Overall, the evidence consistently demonstrated positive effects of oral health education interventions on improving children's oral hygiene. Interactive educational media—including animated videos, educational videos, audiovisual approaches, multimedia applications, and experiential learning strategies—generally produced greater improvements in oral health knowledge, preventive behaviors, and clinical oral hygiene indicators than conventional educational approaches such as lectures, leaflets, or posters. Several studies further indicated that combining multiple educational media yielded the greatest improvements in oral hygiene outcomes among school-aged children.

Quality of the Included Studies

Overall, the methodological quality of the included evidence was considered satisfactory because the review incorporated studies representing multiple levels of scientific evidence, ranging from randomized controlled trials and quasi-experimental studies to systematic reviews, meta-analyses, and an umbrella review. The predominance of experimental and quasi-experimental designs strengthened the internal validity of the evidence by allowing evaluation of causal relationships between educational interventions and oral hygiene outcomes. Furthermore, the inclusion of high-level evidence syntheses enhanced the overall robustness and generalizability of the review findings.

Nevertheless, methodological heterogeneity was evident across the included studies. Considerable variation existed in intervention modalities, duration and frequency of educational sessions, participant characteristics, outcome measurement instruments, and follow-up periods. In addition, several studies were conducted using quasi-experimental or community-based designs without random allocation, potentially increasing the risk of selection bias and limiting comparability across studies. Despite these limitations, the consistency of positive findings across different study designs and settings supports the reliability of the overall conclusion that oral health education media effectively improve oral hygiene among school-aged children.

Effectiveness of Health Education Media on Oral Hygiene

The findings consistently demonstrated that health education media significantly improved oral health knowledge, attitudes, toothbrushing practices, oral hygiene behaviors, and clinical oral health outcomes among school-aged children. Nearly all included studies reported statistically significant improvements following educational interventions, regardless of the educational medium employed. However, the magnitude of improvement differed according to the type of educational media. Interactive and technology-assisted interventions including animated videos, educational videos, audiovisual media, multimedia software, experiential learning, educational games, and smartphone-based applications consistently outperformed conventional educational approaches by producing greater improvements in knowledge acquisition, behavioral change, and reductions in plaque accumulation.

Several studies also demonstrated that school-based oral health education programmes incorporating practical toothbrushing demonstrations and repeated reinforcement significantly improved Oral Hygiene Index-Simplified (OHI-S), plaque index, gingival health, and oral hygiene behaviors. Furthermore, interventions involving parents and teachers, particularly those combining multimedia education with supervised toothbrushing practice, achieved more sustainable behavioral improvements than one-way educational sessions alone. Educational media combining visual, auditory, and interactive components enhanced children's attention, motivation, knowledge retention, and self-efficacy, thereby facilitating long-term behavioral change.

Taken together, the evidence indicates that interactive and multimodal educational strategies are more effective than traditional printed educational materials or lecture-based instruction for improving oral hygiene among school-aged children. These findings support the integration of digital technologies, multimedia learning, and school-based interactive educational programmes into routine oral health promotion initiatives to maximize preventive outcomes and promote lifelong oral hygiene behaviors.

DISCUSSION

This systematic review synthesized evidence from 28 studies published between 2016 and 2026 to evaluate the effectiveness of health education media in improving oral hygiene among school-aged children. Overall, the findings consistently demonstrate that oral health education interventions significantly enhance children's oral health knowledge, attitudes, tooth-brushing practices, oral health literacy, self-efficacy, and clinical oral hygiene outcomes, including reductions in plaque accumulation and improvements in gingival health. These findings reinforce the important role of school-based health education as a cost-effective strategy for preventing oral diseases during childhood.

A study by Puspitawati et al. (2022) demonstrated that flipchart media were effective in improving oral health knowledge among students at SDN Cempaka Putih Timur 03, with a statistically significant difference between pre- and post-intervention scores ($p < 0.001$). Flipcharts represent a simple yet effective educational tool for delivering health information, including dental health education (DHE). Their effectiveness lies in presenting concise and practical health messages accompanied by direct explanations from the educator, thereby enhancing learners' understanding and retention of educational content. In this study, the flipchart incorporated attractive illustrations and clear, concise text, which facilitated comprehension and engagement among elementary school students.

Jumriani et al. (2025) reported substantial improvements in oral health knowledge among elementary school children following an educational intervention using animated videos. Across all grade levels (Grades I–VI), students demonstrated a marked shift from lower to higher knowledge categories after the intervention. Grade I students improved from 55% in the poor knowledge category to 75% in the good category, Grade II from 55% to 80%, Grade III from 55% to 90%, Grade IV from 45% to 100%, Grade V from 40% in both the fair and good categories to 100% in the good category, and Grade VI from 45% to 100% in the good category. These findings indicate that animated video-based education is highly effective in enhancing oral health knowledge among primary school children across different age groups.

Health promotion and disease prevention encompass a range of planned activities designed to improve individual and community health through integrated strategies, including behavior change interventions, health education, risk detection, and health promotion and maintenance. In contrast, curative and rehabilitative interventions are generally directed toward individuals requiring treatment or recovery (Belinda & Surya, 2021). Within this framework, oral health education is defined as all efforts and activities aimed at maintaining oral health and increasing awareness of the importance of dental and oral hygiene (drg. Yessy Andriani Fauziah et al., 2026). The use of appropriate educational media is essential for effectively communicating health messages, enabling target populations to receive, understand, and apply oral health information more successfully (Darmawan et al., 2025).

School-based oral health promotion programs provide an effective platform for improving children's oral hygiene because schools offer repeated opportunities for health education, with children spending a substantial portion of their daily lives in educational settings (Pasaribu et al., 2025). Furthermore, integrating oral health education into the school curriculum ensures continuous exposure to health messages, thereby facilitating sustainable behavioral change. Several systematic reviews included in the present review concluded that school-based educational interventions achieve greater effectiveness when oral health education is delivered repeatedly over time rather than as a single educational session (Mawardika et al., 2025). These findings highlight the importance of continuous, structured, and interactive educational strategies in fostering long-term improvements in oral hygiene knowledge and behavior among school-aged children.

The findings of this review have important implications for public health practice. Educational interventions should move beyond traditional lecture-based approaches toward more engaging, interactive, and technology-assisted learning methods. Schools should integrate oral health education into routine health promotion activities while strengthening collaboration among teachers, parents, dental professionals, and primary healthcare centers. Interactive digital media, including educational videos, animation, mobile applications, and multimedia learning platforms, offer promising opportunities to improve children's engagement and sustain behavioral change. Future research should prioritize well-designed randomized controlled trials with larger sample sizes, standardized outcome measures, and longer follow-up periods to determine the long-term effectiveness and cost-effectiveness of various educational media in improving oral hygiene among school-aged children.

CONCLUSION

This systematic review demonstrates that health education media are effective in improving oral health knowledge, attitudes, oral hygiene behaviors, and overall oral hygiene status among school-aged children. Interactive educational approaches, particularly educational videos, toothbrushing demonstrations, educational games, and multimedia-based interventions, consistently produced greater improvements than conventional printed materials such as leaflets and booklets. In addition to enhancing oral health knowledge, these interventions contributed to significant reductions in dental plaque scores, improvements in the Oral Hygiene Index-Simplified (OHI-S), and increased adherence to appropriate toothbrushing practices. The effectiveness of oral health education interventions was influenced by several factors, including the type of educational media, the frequency and duration of educational sessions, and the active involvement of teachers, healthcare professionals, and parents in reinforcing oral hygiene practices. These findings highlight the importance of adopting learner-centered, interactive educational strategies that actively engage children and facilitate sustained behavioral change.

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