
| RESEARCH ARTICLE

Strategies to Improve Dental Hygiene and Oral Health of 5-15-year-old Students: A Systematic Review

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| ABSTRACT

School is the most cost-effective and easiest way to access 5-15-year-old children. Owing to the development of permanent teeth, the increasing prevalence of dental caries, and the formation of social life, these children are the main target group in oral hygiene promotion programs. The present study aimed to evaluate the effect of interventional strategies on improving oral health and dental hygiene of 5-15-year-old students. Electronic search in Scopus, PubMed, Science Direct, Springer, and Biomed Central databases was performed using English keywords, and the studies that were conducted on educational interventions to improve oral health, dental hygiene, prevention, and control of caries among students between January 2004 and March 2021 were reviewed. Thirteen selected studies were divided into two categories: educational interventions based on self-care behaviors and prevention services (fluoride varnish and fissure sealant) and educational interventions based on self-care behaviors. Interventions that included continuing the intervention, involved parents and school staff in the program, used a combination of several educational methods and used preventive services were associated with greater success in enhancing knowledge, health behaviors, reducing plaque, and tooth decay. Continuation of group education, combined use of educational programs, follow-up, and the use of behavior change models and provision of preventive services are the best ways to design and plan an intervention to improve oral health and dental hygiene in elementary school students.

| KEYWORDS

Oral Health, Dental Hygiene, Preventive Services, Children, Oral Health and Dental Hygiene Education

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1. Introduction

Periodontal disease and dental caries are the most common chronic oral diseases. At present, oral health and dental hygienes are an essential need and a part of public health. Lack of observing it can lead to dental problems, lower general health, lower self-esteem, chronic infections, and reduced quality of life, especially in children. Thus, paying attention to this issue is one of the main goals of the World Health Organization in the area of prevention of chronic diseases and health promotion. Moreover, due to the high prevalence of tooth decay and the development of permanent teeth, and the formation of beliefs, habits, and social life, children aged 5 to 15 years need oral health and dental hygiene improvement programs. Changing and improving the health of this group of children can have lasting and significant effects on the health of the next generation of society. Researchers believe that enhancing the knowledge of this age group is the only way to improve the oral health and dental hygiene of society. School is the easiest and most cost-effective way to access this age group. Problems such as time, cost, facilities, and equipment are preventive factors in dental treatment, and overcoming these problems is the most important way to reduce and prevent oral diseases. The most effective strategy in this area is to implement health promotion interventions and implement educational strategies and activities. Different health education strategies in accordance with new learning methods are the most effective and shortest way to achieve the goal of improving oral health in children. These strategies can reduce oral diseases by 80% in this age group. Several studies have indicated that various models and methods for oral health promotion interventions have been implemented in different countries. The most important and basic principle of education to reduce oral diseases is to consider lifestyle-related behaviors. This study reviews interventional studies and educational programs to reduce tooth decay and improve

oral health and dental hygiene of students aged 5 to 15 years. The present study aims to present interventional strategies that can be effective in reducing tooth decay and promoting oral health-related behaviors in this age group.

2. Materials and Methods

In this systematic review, studies conducted on intervention strategies to improve oral health, prevention, and control of caries among 5-15-year-old students were reviewed. The focus of this study was on the design of the intervention and the application of theories of behavior change, and the duration of interventions.

2.1 Search strategy

In this study, articles published between March 2012 and January 2021 in the Scopus, PubMed, Science Direct, Springer, and Biomed Central databases were searched using the keywords of Oral Health, Control, Prevention, Intervention, Education, Theory and Model, Children and Elementary School.

2.2 Inclusion criteria of the studies

The target group includes students aged 5 to 15 years, using educational interventions or educational interventions combined with preventive services (fluoride varnish and fissure sealant), articles published in English, transparency of the procedure, the way of implementing the intervention, intervention in the school setting and in both genders, the result includes reducing tooth decay, increasing oral health, or improving oral health-related health behaviors. Descriptive and qualitative studies, as well as intervention studies limited to therapeutic activities (early treatment of caries) and preventive measures without education (fluoride varnish and fissure sealant) and also studies conducted on only one gender, were excluded.

In the present study, experimental and quasi-experimental articles that completely explained the implementation method (how to implement the intervention, number of educational sessions held, duration of each educational session, educational materials in each session, educational content, questionnaire, etc.) and results reporting indices related to oral health or behaviors related to oral health) were considered high-quality articles, and articles that mentioned only the number of educational sessions held and the content of the sessions and results were ambiguous were considered low-quality articles.

3. Results

Our searches led to 598 articles. After reviewing the abstracts with the aim of removing irrelevant items, 267 full-text articles remained. All the mentioned studies were reviewed by the author, and the articles were classified into three folders as approved articles, rejected articles, and under review articles. In the next step, 38 articles were found as low-quality articles and in need of joint review, and 229 articles were excluded (156 articles with the non-student target group, 29 articles with the target group of students outside the desired age group, 13 articles on students with a specific disease, 24 articles with therapeutic and preventive interventions alone and 7 articles in only one gender).

Based on the determined protocol, the approved and low-quality articles that were selected for review were once again reviewed by the researcher, and finally, 13 articles were approved (figure 1). Interventions were divided into two categories: educational interventions based on self-care behaviors and prevention services (fluoride varnish and fissure sealant) and educational interventions based on self-care behaviors.

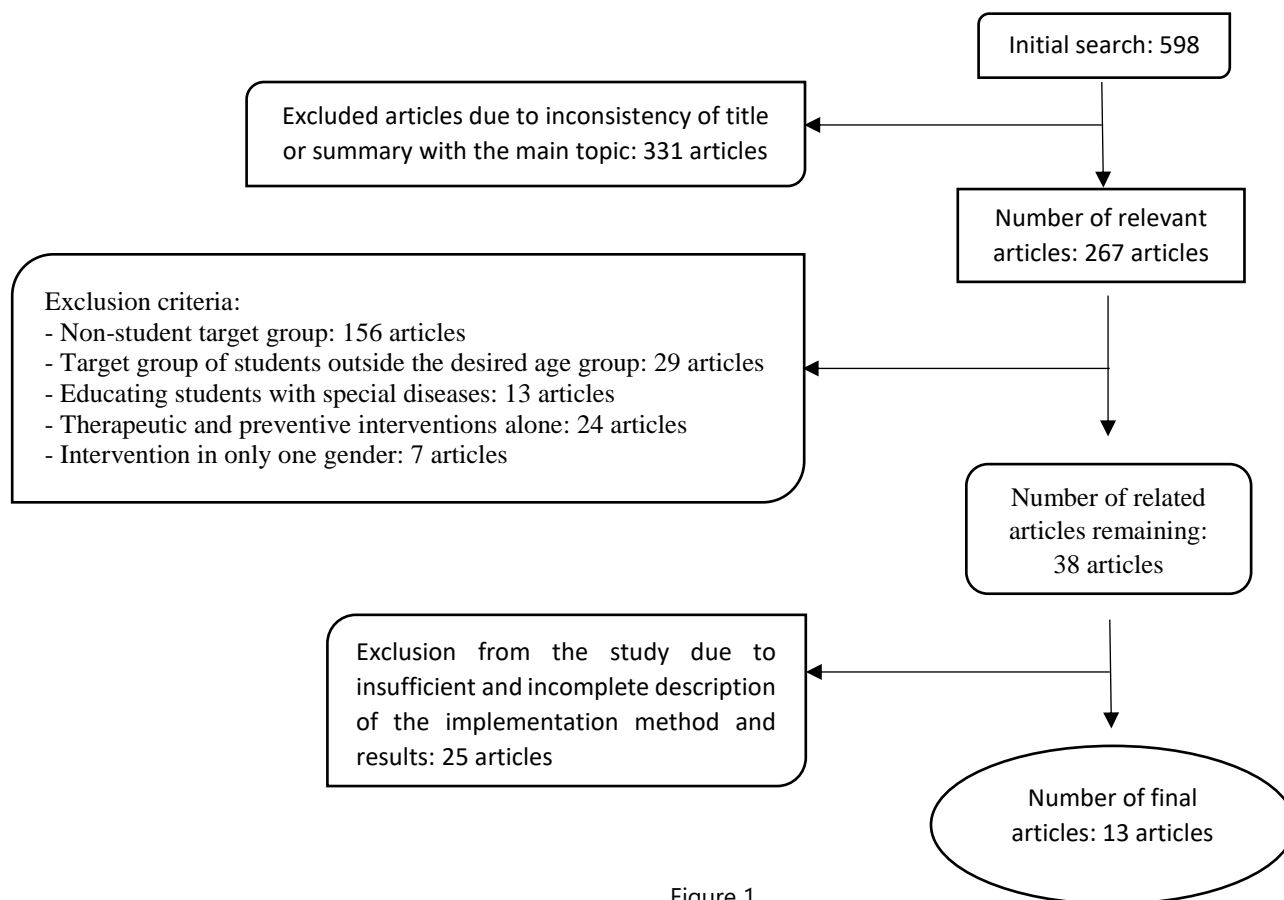


Figure 1

Authors	Aim of study	Target group	Duration of study	Intervention	Results
	Evaluation of the effectiveness of oral health interventions with educational and preventive components	10-11-year-old students	6 years	Education on the cause of caries, gingivitis, reducing the consumption of sugary substances, using fluoride toothpaste, and the correct method of brushing Fluoride prevention services, varnish, and betadine use	Significant differences were observed in the level of knowledge, dental plaque index, gingival health, and the rate of spread of tooth decay before and after the intervention.
	Comparison of the effectiveness of oral health education based on experimental learning (EL) and traditional lecture (TL) on knowledge, attitude, habits, oral health, gum health, and caries incidence	13-year-old students	2 years	The EL Oral Health Education Program was implemented by teachers using the program guideline.	Oral health knowledge was significantly improved after the intervention in both groups (P <0.001). Oral health behavior (P <0.001) and attitude (P <0.05) were significantly improved at 6 months, and oral health and gingival health were significantly improved after 6 (P <0.001) and 18 (P < 0.05) months in the EL group.
	Investigating the effect of oral health education programs on promoting students' oral health	6-12-year-old students	4 years	Adding an oral health promotion program to the curriculum	Significant increase brushing at least once a day and before bed Improving oral health

				Teaching by content provided by teachers and in the local language Daily brushing at school Fluoride varnish for 6 months	Enhancing knowledge in the area of oral health and hygiene
	Comparison of the effectiveness levels of oral health education strategies	10-11-year-old students	2 years	Leadership-based and self-learning education Holding a one-hour educational session by the dentist, teacher, and peer group Presenting an oral health educational booklet to students	-All three leadership-based oral health education strategies had a higher statistical mean in the scores of OHK, OHB, OHS, and KBC than the self-learning and control group. -The self-learning group had a significantly higher OHB score than the control group
	Evaluation of a brief oral health promotion intervention offered in schools by a primary care dental office aiming to improve oral health care knowledge and behaviors related to oral health in children.	9-12-year-old students	6 weeks	The children received a 60-minute interactive educational session presented by a dental care professional and received oral hygiene articles to read at home.	Pediatric dental knowledge improved significantly after the intervention. This improvement was maintained in the immediate follow-up and 6 weeks later. The number of children who flossed 6 weeks after the intervention was significantly higher than at the beginning of the study. No significant differences were observed in brushing or dieting behaviors.
	Evaluating the short-term and medium-term effectiveness of an oral health-based intervention to promote primary care.	5-6-year-old students	2 years	School-based health promotion activities	In the intervention group, compared to the control group, an increase in oral health knowledge and an increase in the consumption of healthy food at breakfast, and a decrease in the consumption of sweets, soft drinks, and sweet juices were observed in the afternoon snacks. No significant improvement in oral health was observed in the students in the intervention group.
	Evaluating the effect of a 4-year oral health promotion program on oral health, knowledge, and socio-economic inequalities in elementary students.	8-11-year-old students	4 years	Providing one oral health education session annually	The intervention had a stabilizing effect on the number of decayed teeth and increased the knowledge score.
	Evaluating the effectiveness of a school-based intervention to increase SOC and oral health-related quality of life (OHRQoL) in socially vulnerable Brazilian children.	8-14-year-old students	3 months	The intervention included 7 sessions of SOC-based activities over 2 months that focused on transforming the school setting into a place for SOC development through the involvement of teachers, school staff, and children.	Children in the SOC-based intervention group reported fewer effects of their oral health on daily life than the control group. The intervention group also reported more improvement in SOC at 2 weeks and 3 months than the control group.
	Evaluation of the effectiveness of oral health education on students' knowledge and behavior	8-10-year-old students	1 year	Oral health education for 45 minutes at 8-week intervals	The positive effect of oral health education for 45 minutes at 8 weekly intervals for 1 year was observed in the intervention group. The intervention had a significant effect on the stability of knowledge and correct behavior of the intervention group

Evaluating the initial effect of oral health education on oral health knowledge of elementary and secondary school students in private schools	8-15-year-old students	1 year	Children were presented 30 minutes of PowerPoint, and an oral health and hygiene video was shown in the school using a computer and projector. An interactive educational session was held before the end of the program.	Elementary school students showed a high mean knowledge ($P < 0.001$) in post-test evaluation.
Evaluation of the long-term effectiveness of children's oral health program in school on oral health	10-11-year-old students	10 years	Teaching guidelines on how to floss and brush daily under the supervision of school nurses for one semester. Both intervention and control groups participated in a questionnaire and received dental examinations after a long follow-up.	The mean total score of plaque in the intervention group (16.9%) was lower than the non-intervention group (32.6%). The clearance percentage in the intervention group (75.0%) was lower than in the non-intervention group (90.8%). The intervention group had lower DMFT values and DMFS scores than the non-intervention group (4.1 and 6.6 vs. 6.2 and 11.0). Also, the intervention group was significantly better in terms of dental knowledge, habits, and conditions than the non-intervention group.
Evaluation of the effect of oral health promotion program, including supervised brushing and providing educational packages for parents on parents' knowledge and students' oral health status	6-7-year-old students	1 year	An intervention package including supervised brushing in the school environment, an educational package for parents, and a home package containing a toothbrush and fluoride-containing toothpaste were provided.	In the intervention group, a significant improvement in oral health was observed. In the post-test evaluation, the improvement score of parents' knowledge about oral health in the intervention group was not different from the control group.
Evaluating and comparing the effectiveness of OHE interventions (peer-led and dentist-led conventional method) on oral health status, knowledge, attitude, and practice of oral health among students	12-15-year-old students	6 months	OHE was presented by a peer group and a dentist (using PowerPoint presentations, chalk presentations, and conversations, using diagrams, posters, booklets, and demo brushing models).	Both peer and dentist-led OHE interventions were effective in improving knowledge, attitude, oral health and hygiene practices, and oral health status at three and six months compared with the control group.

Table 1

4. Discussion

The present review study evaluated the interventions performed in school to improve the oral health of students aged 5 to 15 years. Thirteen final studies were divided into two categories: evaluation of educational interventions based on self-care behaviors and prevention services (first category) and evaluation of educational interventions based on self-care behaviors (second category). The goals of these studies are divided into two categories: 1) Short-term goals (enhancing knowledge, improving attitudes and behaviors of students in improving oral health, changes in dental plaque indices, gingival bleeding, caries activity) and 2) Long-term goals (changes in dental caries indices including DMFT and ICDAS). A review of studies evaluating the effectiveness of educational and preventive interventions showed that this type of intervention has a positive effect on improving oral health, reducing caries, and increasing oral health-related behaviors. These studies suggest that although educational programs to enhance knowledge, change attitudes and improve self-care behaviors in students are a priority, adding preventive strategies significantly reduces dental caries in this age group. The study conducted by Pieper showed that providing preventive services, even without changing health knowledge and behaviors, reduces tooth decay in students. However, various studies have indicated that although the provision of preventive services alone has been successful in reducing tooth decay, it is less successful compared to other studies, and for greater effectiveness, it should be combined with planned education and periodic follow-ups.

When the provision of preventive services was used as part of a comprehensive prevention plan, along with six months of oral health hygiene education and topical use of fluoride, caries were reduced by 87.5 percent over three years. In other words, preventative measures such as fluoride therapy and fissure sealants are not alternatives to daily oral health and hygiene measures,

including brushing and flossing and merely play a complementary role. If these behaviors do not become part of a person's lifestyle from childhood, there will be tooth decay will increase sharply in the future due to reduced volume of sealants, premature failure, or the end of their effectiveness period. Thus, the need for educational programs to increase oral health-promoting behaviors is being felt, especially in children. The results of the implementation of two programs for the prevention of dental caries in children in Finland showed that normal health education and preventive interventions in the dental clinic could not significantly improve oral health-related and hygiene behaviors. As educational studies based on self-care behaviors have shown, model-based interventions and interventions that have been performed continuously and use a combination of several educational methods such as instructional videos, games, and group activities reported higher knowledge, better oral health and hygiene, higher health behaviors, and lower rates of plaque and dental caries than intervention groups who used an educational method. Studies also suggest that involving parents, especially mothers and teachers, in education is more effective in improving children's health behaviors than the self-learning method, so the intervention groups that involved parents and school staff in the program compared to the intervention groups taught only students achieved better results in enhancing knowledge, improving attitudes, improving oral health, gum health, and related health behaviors. Limited access to the full text of the study in some databases such as Wiley and Cochrane, lack of mastery and access to non-English language translators, and incomplete description of the implementation method is among the limitations of this study. These limitations prevented to review of some of the above databases, and in the reviewed databases, only articles whose full text was accessible were reviewed, and non-English language studies were excluded from the study.

5. Conclusion

Two categories of interventions, including 1) teaching students' oral health-promoting behaviors and providing preventive services, and 2) teaching students' oral health-promoting behaviors have positive effects on children's oral health and hygiene. In this regard, strategies for educating students and involving parents and school staff in education have a higher effect on promoting oral health and enhancing knowledge, improving attitudes, and changing students' behavior. This review found that there were very few good-quality studies that reviewed oral health promotion interventions targeting students, which had a low risk of bias. Prospective research should use more effective theory-based interactive strategies, including self-awareness, and they should use the larger community and peers to improve oral health activities over a longer intervention duration. Also, a continuation of group education, well-developed education, the combined use of models and theories of behavior change, and follow-up and prevention services are the best ways to design and plan an intervention to promote oral health and hygiene in elementary school students.

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