

Original Research Article

Meta-Analysis: Effectiveness of Dental Health Education with Plaque Control in Children 6-12 Years Old

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Article History

Received: 07.05.2024

Accepted: 12.06.2024

Published: 26.06.2024

Journal homepage:

<https://www.easpublisher.com>

Quick Response Code



Abstract: Introduction: Dental and oral health problems in the world are still very concerning. Many dental health programs have been carried out. Plaque control is one way to maintain oral hygiene. The research objective was to determine the effectiveness of a dental health program based on plaque control in elementary school-age children. A systemic review of the meta-analysis was designed based on the Preferred Reporting Item for System Review and Meta Analysis). **Methods and Material:** Data search was conducted on the PubMed and Google Scholar databases. Articles published between 2012-2022 with inclusion criteria: Population (P): Children aged 6-12 years, boys and girls. Intervention (I): Dental health education for plaque control programs in schools. Comparison (C): schools without dental health programs. Outcome (O): Index plaque. Study Design (S): Experimental Study with Random Control Trial. The keywords used are: Dental Health Education. Exclusion criteria: research without ethical clearance, children with special needs. Screening process: Screening was carried out by 4 (four) researchers. **Statistical Analysis used:** Analysis data used Revman. **Results:** The research results table shows a difference in plaque scores between the pre-test and post-test. And the P value between the intervention group and the control group found a significant difference. **Conclusions:** Dental health education programs conducted in schools can reduce plaque scores in children 6-12 years old.

Keywords: Children, Dental Health, Education, Plaque Control.

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INTRODUCTION

Dental and oral health problems in the world are still very concerning. The most common oral diseases are dental caries, gingivitis, and periodontitis dental caries, gingivitis and periodontitis. This disease affects children to the elderly. Dental caries and gingivitis are common diseases that affect the whole world. Based on research studies, caries in primary and permanent teeth in children worldwide from 1999 to 2019 is quite high. (Kazemina *et al.*, 2020). According to (Basavaraj Patthi *et al.* (2017), the trend regarding the incidence of dental disease, namely gingivitis and periodontitis, increased by 7.9 million. This number was double that in 2010, and the number of dental caries patients increased from 5.34 to 5.84 million. Lack of oral hygiene is the main factor causing caries and etiology of periodontal disease (79.85% and 62.93%, respectively). (Ministry of Health, 2018) Significant differences in dental caries prevalence were found according to sex, province, urban/rural residence, family income and parents' level

of education (Bayat-Movahed *et al.*, 2011). Systemic review of dental caries in published literature (until December 2020) in East Africa, the overall prevalence of dental caries was comparatively high. Being female and poor oral health practice were independent risk factors of dental caries (Teshome, Muche, and Girma 2021). Prevalence of Dental Caries among Children of Aged 6-12 Years in Tamilnadu - A Systematic Review Among the included studies, five studies were carried out in the Chennai district. Erode district was found to have the highest prevalence of dental caries at 89.3% (Suganya *et al.*, 2021).

Preventive measures need to be taken to reduce the occurrence of dental and oral diseases because if ignored they will have a significant impact on personal circumstances such as disruption of activities, expenditure of financial costs for curative actions and social impacts. Nurwati (2019) had research on children aged 5-7 years children with an average caries

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experience of 9.05 teeth per child showed that 58% of children often bothered by pain, 44.2% often and 1.4 very often have difficulty drinking hot and cold and 38% often do not go to school.

Therefore, health promotion actions are needed so that people are able to manage and improve their health independently. Dental health education is the most important part of health promotion to increase knowledge, attitudes and behavior towards dental and oral health. Health promotion needs to be given to children as early as possible and to school-age children so that it is hoped that it will affect their knowledge, attitudes and lifestyle. School-age adolescents urgently need prevention programs to ensure long-term good oral health and hygiene (Subedi *et al.*, 2021).

Health promotion carried out in schools is expected to improve children's dental and oral health. Much research has been done on health education in schools. Oral hygiene is closely related to the presence of dental plaque. Plaque is the cause of dental and periodontal tissue disease (Teughels W, Quirynen M, 2011). Plaque is a very specific structural entity, which is formed by the colonization of microorganisms on the tooth surface and is transparent, so that plaque is not easily visible to the naked eye and difficult to remove. Therefore, disclosing agents are used, namely preparations containing dyes or disclosing agents for the identification of bacterial plaque for the purpose of removing dental plaque in maintaining oral hygiene (Patra 2011). Removal of dental plaque is considered a basic necessity in preventing this disease (Prasad *et al.*, 2011). Mechanical plaque control procedures are effective in reducing plaque and gingivitis. The addition of fluoride to mechanical plaque control is significant for caries management. Chlorhexidine rinse has a positive effect on gingivitis and inconclusive role in caries (Figuro *et al.*, 2017).

Various methods are used to obtain maximum results. Learning media must fulfill 3 main functions, namely: providing motivation, presenting information, and providing instructions. In order to have a motivational function, learning media can be realized in the form of drama or entertainment. The media also functions for instruction where the information contained in the media must involve students either in thought or in the form of real activity. Materials are designed systematically and psychologically from learning principles in order to prepare effective instruction. Learning media must be able to provide a pleasant experience and meet needs.

Health education programs for children are mostly carried out in schools, but some are also carried out at home. Human behavior is often explained in terms of one-sided determinism. Behavior is described as being shaped and controlled by either environmental influences or internal dispositions. In the social cognitive model, the

causal model involves triadic reciprocal determinism. In this model, reciprocal causation of behavior, cognition and other personal factors, and environmental influences all operate as interacting determinants affecting one another. Mutual causation does not mean that the various sources of influence are equally powerful. One factor may be stronger than the other, and there may not be a mutual influence occurring simultaneously.

A study in Iran showed a significant correlation between the frequency of tooth brushing per day and mean dmf-t, mean DMF-T and gingival health ($p < 0.05$). Also, a significant association was detected between frequency of tooth brushing per day by the students and frequency of brushing by their parents. Such correlation was also observed between the frequency of brushing by the mother and father ($P < 0.05$). Prevalence of dental caries among 6 to 12 year-old Kermanshah students was higher than the WHO standards. In order to improve the current situation, a proper programming seems necessary. Furthermore, more attention must be paid to the education of families about dental and oral health and preventive dentistry. This education can be implemented through the media, health care centers and health supervisors in schools (Mohammad Reza Nokhostin, Akram Siahkamari 2013).

The aim of the study was to evaluate dental health education with a plaque control program conducted in schools on plaque scores.

SUBJECTS AND METHODS

The systemic review meta analysis was designed based on the Preferred Reporting Item for System Review and Metha Analysis (PRISMA). Data search was conducted on the PubMed and Google Scholar data bases. Articles published between 2012-2022 with inclusion criteria:

Population (F): Children aged 6-12 years boys and girls

Intervention (I): Dental health education for plaque control programs in schools

Comparison (C): schools without dental health programs

Out come (O): Index plaque

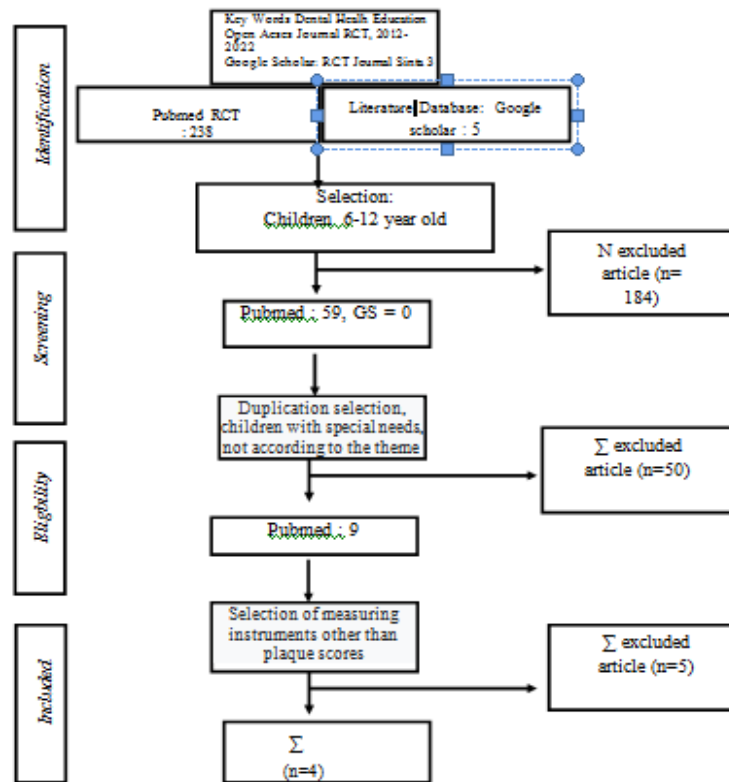
Study Design (S): Experimental Study with Random Control Trial.

The keywords used are: Dental Health Education.

Exclusion Criteria: Research without ethical clearance, children with special needs.

Screening Process: Screening was carried out by 3 (three) researchers independently. In the first stage an analysis of the title and abstract was carried out and in the next stage the analysis was carried out by selecting manuscripts by taking into account the inclusion and exclusion criteria. If there is a gap between researcher 1 and researcher 2, researcher 3 is the intermediary. If there are things that are not clear from the research results, the researcher will make contact with the script writer via email. The search results for the article are presented in

Figure 1. Keywords Dental Health Education, 2012-2022, RCT.



Picture 1. PRISMA Flow Charts

(Preferred Reporting Items for Systematic Reviews and Meta-analyses)

A search on PubMed with the keyword dental health education found 238 articles and on Google Scholar found 5 articles. After screening only articles with programs for children aged 6-12 years old, 184 manuscripts were excluded, leaving 59 articles. Then screening was carried out by excluding children with special needs so that there were only 9 articles left. Furthermore, the selection of measuring instruments was carried out, namely only the plaque score to be analyzed and found 4 articles.

RESULTS

Research data were collected from 4 articles that met the criteria. The first research carried out by (Al Bardaweel and Dashash 2018). His research about on E-learning or educational leaflets. The second research by (Subedi *et al.*, 2021) is about Effectiveness of oral health education intervention among 12–15-year-old school children in Dharan, Nepal: a randomized controlled trial dan research. The third research by (Wei *et al.*, 2021) about Effects of health-promoting school strategy on dental plaque control and preventive behaviors in schoolchildren in high-caries, rural areas of Taiwan, this research is a quasi-experimental design.

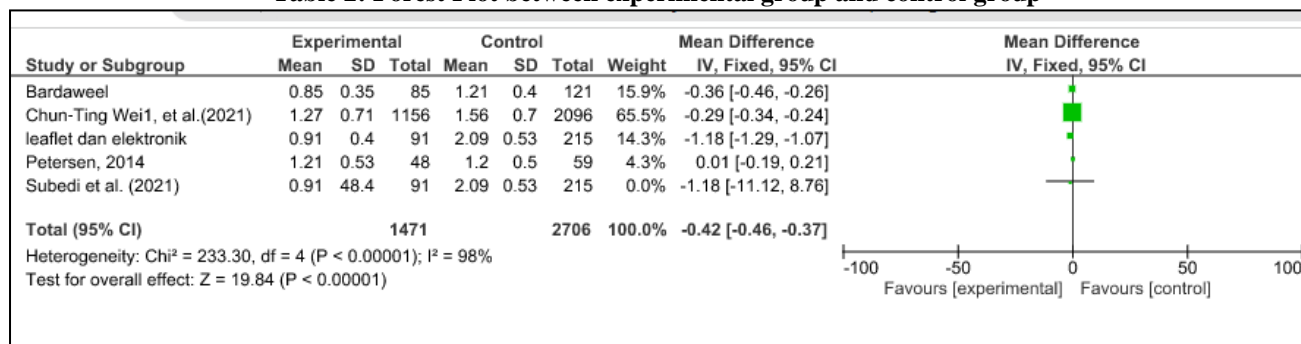
Table 1: Plaque score before and after dental health education in children 6-12 year old

			p (value)		N		PLAQUE SCORE								
			Type of Research	Intervention	Control	Intervention	Control	Intervention Pretest		Control pretest		Intervention Postest		Control Postest	
								mean	SD	mean	SD	mean	SD	mean	SD
1	Susan Al Bardaweel and Dashash (2018) 18:81	RCT	experimental	0.001	0.001	100	100	2.25	0.43	2.33	0.38	0.85	0.35	1.21	0.4
2	Chun-Ting Wei1, et al.(2021)	RCT	experimental	ES 0.63 Koeffreg. -0.36 (-0.59, -0.13)		44	49	1.7	0.5	1.5	0.6	1.1	0.53	1.2	0.5
3	Petersen 2014	RCT	experimental			910	1343	1.54	0.53	1.55	0.56	1.27	0.71	1.56	0.7
4	Subedi et al. (2021)	RCT	experimental	0.001	0.026	99	103	2.15	0.52	2.19	0.41	0.91	0.4	2.09	0.53

The research results table it can be seen that there is a difference in plaque scores between the pre test and post test. And the p value between the experimental

group and the control group found a significant difference

Table 2: Forest Plot between experimental group and control group



From the results of the forest plots it can be seen that the sample is very heterogeneous (p < 0.05) and a significant difference between experimental group and control group (p < 0.05).

DISCUSSION

Education Media for Children

The early recognition of technology together with great ability to use computers and smart systems have promoted researchers to investigate the possibilities of utilizing technology for improving health care in children. A clustered randomized controlled trial at two public primary schools was performed about 220 schoolchildren aged 10–11 years were included in this study and grouped into two clusters. Children in Leaflet cluster received oral health education through leaflets, while children in E-learning cluster received oral health education through an E-learning program. A questionnaire was designed to register information related to oral health knowledge and to record Plaque and Gingival indices. The results of the study showed that the leaflet cluster (107 participants) had statistically significantly better oral health knowledge than the E-learning cluster (104 participants) at six weeks (p < 0.05) and at 12 weeks (p < 0.05) (Leaflet cluster:100 participants, E-learning cluster:100 participants). The mean knowledge gain compared to the baseline was higher in the Leaflet cluster than in the E-learning cluster. A significant reduction in the PI means at six weeks and 12 weeks was observed in both clusters (p < 0.05) when compared to baseline. Children in the Leaflet cluster had significantly less plaque than those in the E-learning cluster at six weeks (p < 0.05) and at 12 weeks (p < 0.05). Traditional educational leaflets are an effective tool in the improvement of both oral health knowledge as well as clinical indices of oral hygiene and care among Syrian children. Leaflets can be used in school-based oral health education for a positive outcome (Al Bardaweel and Dashash 2018).

That short term oral health education programs may be useful in improving oral hygiene practices in

children. Educational instructional leaflets are appropriate effective economic tools for improving oral health. the learning process shows results that have a high effect on improving student learning outcomes. This is evidenced by changes in the improvement of student learning process activities. This increase in learning outcomes can be seen from the level of activity of students in asking questions, the activity of students in expressing opinions in discussions and also the activity in working in groups and also from the comparison of tests that have been carried out. With an increase in student learning outcomes after using leaflet media, it is hoped that it can help teachers and students achieve more optimal learning goals in the learning process(Wahyuni 2022). Leaflets are one of the effective media used in the promotion of oral health in elementary school children (Arista, Hadi, and Soesilaningtyas 2021) The Leaflet shows an increase of knowledge is greater than the use a pocketbook(Mona and Azalea 2018).

Dental health program for elementary school students is effective in increasing their knowledge and behavior regarding dental health but the lack of significant differences in several of the variables in this study may be related to the education provided to the control group using a booklet.(Ahn and Yi 2010)

Health Promoting School Strategy

Research in Taitung Taiwan by (Wei *et al.*, 2021) conducted on children with high caries incidence in order to evaluate the effects of school health promotion program through plaque control and health behavior. This study developed six HPS (Health Promoting School) frame work domains: a) School Policy. School policies include brushing their teeth for 3 minutes while sitting in class room after lunch and limiting consumption of sugary snacks and drinks between meals at school. The school teacher's job is to supervise the children brushing their teeth after lunch b) Physical environment. The physical environment condition includes the school environment and all its facilities and equipment. The Dental Hygienist monitors the suitability of toothbrushes, including toothbrushes

with small heads and soft bristles, and ensures that the fluoride level reaches more than 1000 ppm when brushing and 0.2% fluoride mouthwash is used once a week by the school children. c) Social environment. The aim of the social environment is to establish a supportive system to train teachers and students to become seed peer leaders. d) The school establishes a reward system to encourage student good oral health behavior and to form students' oral hygiene habits e) Health related skills f) To increase knowledge and skills related to oral health, a 40-minute classroom teaching session was held for students on oral health education, an oral health education session for parents, and an oral dental health led by a dental hygienist with workshop activities. for empowering teachers g) Health services. School nurses are advised to monitor children's caries status and provide individual caries counseling for high-risk children. The school also provides free fluoride varnish and fissure sealant applications h) Public relations. Schools communicate with their local shops and set up sugar-free shops to reduce access to sugary foods and drinks.

The school also works closely with local dental clinics which reduces medical costs for local schools and assigns dentists to schools to provide medical services for school children. The results showed that, compared to the control group, the intervention group had a greater decrease in plaque index among second grade students ($\beta= 0.36$) and plaque control score scores among second, fourth, and sixth grade students ($\beta= 27.48, -26.04, \text{ and } -18.38$). The intervention group also showed a greater increase in follow-up with respect to oral health-related knowledge among second and fourth graders ($\beta=1.46$ and $=0.92$, respectively), attitudes toward oral hygiene behavior among sixth graders ($\beta=1.78$), and self-efficacy regarding flossing for sixth graders ($\beta=1.43$). The sixth graders in the intervention group were significantly more likely to brush their teeth before going to bed (adjusted odds ratio [aOR] = 2.99) and using fluoride toothpaste (OR=5.88) compared to control. The results of this study state that the Health Promoting School Strategy is effective in reducing dental plaque and encouraging the prevention behavior of school children with high caries in rural areas (Wei *et al.*, 2021).

Study (Nagashima *et al.*, 2018) whether self-checking using a plaque cleaning solution can improve oral hygiene in school children living in orphanages. At the beginning of the research program this was carried out by giving instructions in groups about oral and dental health for 20 minutes. Then the teeth were checked for cleanliness with a PCR (Plaque Control Record) O'Leary TJ, Drake RB, Naylo *cit.* (Nagashima *et al.*, 2018) after being smeared with disclosing solution.. After one month the respondent was given instructions on how to brush his teeth individually and every week for 3 months, checked by a dental hygienist where previously the respondent had checked himself. During these 3 months no instructions were given about brushing teeth. After the 3rd month, another examination was carried out and

individual instructions were given. In the following month then PCR, PHPM and interviews with questionnaires were examined. The results of the study in the faster care children showed that the PCR decreased significantly to 38.7% after 3 months self-checking using disclosing solution compared to before checking (ie, at 1 month) (60.7%) ($P < 0.01$). The PHP score decreased significantly to 1.4 at 4 months compared to baseline (2.8) and at 1 month (2.7) ($P = 0.012$ and $P = 0.018$). Although there was no control group in this study, self-examination with plaque-dissolving solutions could play an important role in improving the oral hygiene of school children in orphanages.

School dental health education had a positive impact on the oral health status, knowledge, and practice behavior of children. There is a definite need for high-quality RCTs analyzing the effectiveness of school dental health education on specific oral health outcomes.

The Survey of Oral-Dental Health of Elementary School Students of Tehran City and its Related Factors had found that Some of the studied students had the oral health knowledge and practice. The more parental educational level is, the more awareness and practice the students get. According to the survey, the richest information resources are teachers and health trainers. It seems that instructor-based educational interventions can be efficient. (Azam Goodarzi, Ali Reza Hidarnia, Sedigheh Sadat Tavafian 2018)

Tri Angulation Manner School Based Dental Health Education Program

At the 24 month examination there were significant improvements in dental plaque scores with greater improvements seen in the intervention group, greater still in the cooperative schools. This study documents the positive effect from use of fluoridated toothpaste (1,450 ppm Fand 1.5% arginine) administered by schoolteachers and undertaken via an enhanced school oral health program. Optimising oral health interventions for young children in Thai schools may have a significant impact on caries incidence resulting in reductions of up to 34% reductions in caries for all schools included in the study and up to 41% for the most cooperative (Petersen *et al.*, 2015).

School-age adolescents urgently need prevention programs to ensure long-term good oral health and hygiene (Subedi *et al.*, 2021). A systemic review was conducted by (Bramantoro *et al.* 2021) of 31 articles from the PubMed and Embase databases to determine the effect of school-based oral health promotion programs on oral knowledge, behavior, attitudes, oral hygiene status, and oral quality of adolescent life involving children, teachers, and parents obtained positive results. The results of the research are the same as the research that explore the common facilitators of delivering oral health advice from dental teams, parents' and children's experiences, to identify and

inform practical recommendations for clinical practice. This study has provided recommendations for child health care services in a broader triangulation manner. by involving parents of students, the school and dental health workers (Bhatti *et al.*, 2021).

Study in West Pomerania Germany carried out by 740 student age 9-12 years (48% female) that recruited from the fifth grade of 18 different primary schools. General and oral health education was provided to the teachers in the intervention schools, which they conveyed to their students. No additional measures were conducted in the control schools. Medical and dental school examinations, as well as questionnaires for the students and their parents were conducted at baseline and follow-up. The program was effective in improving dental health among children with high socio-economic status., but no preventive effect could be found in low socio economic status group. (Ghalib Qadri Mohammad Alkilzy Marco Franze Wolfgang Hoffmann Christian Splieth 2018) Therefore it is necessary to implement a dental health program in schools need to consider the socio-economic factors of their parent.

A total of 385 Turkish elementary school teachers participated to study of correlation between their perceived knowledge and actual knowledge by evaluate levels of oral health knowledge, attitudes, and behaviours. The correlation between their perceived knowledge and actual knowledge was very weak, thus suggesting that the teachers are inclined to overestimate their knowledge. The Turkish elementary schoolteachers showed satisfactory oral health knowledge and attitudes toward oral health education. The teachers' knowledge about dental trauma management was inadequate, necessitating urgent educational interventions, especially for physical education teachers, who are at the greatest risk of encountering such events during their work. The oral hygiene behaviours were not associated with teachers' oral health knowledge, attitudes, or practice, thus requiring further investigation.(Yilmaz *et al.*, 2021). Results of this study suggest that mothers involvement in the dental health program is effective in reinforcing dental health enhancing behavior in elementary school children (Choi and Ahn 2012). The dental health education of teachers and parents (mothers) supported by the 16-surface teeth brushing program significantly reduced the dental plaque index in children aged 7–9 years old (Setiawati *et al.*, 2020).

A randomized controlled trial was conducted with parallel study groups, consisting of schoolchildren aged 12-15 years in Dahrn City, Nepal, with 120 children in each group. Oral Hygiene Education was given to the experimental group at the beginning, third and sixth months and to the control group after the completion of the study. Participant interviews were conducted using a 23-item questionnaire to assess oral hygiene which included knowledge, attitudes and actions. Oral health examinations were performed using

a mouth mirror and WHO probe to record the Turesky–Gilmore–Glickman modification of the Quigley-Hein plaque index, Gingival index and status of Dental treatment needs.(Subedi *et al.*, 2021). The average plaque score decreased after the intervention, whereas in the control group there was no decrease in plaque score. The results of the study on school children in Dahrn City found that there was an increase of 54.58% in knowledge, attitudes and actions regarding oral hygiene as a whole in the experimental group ($P = 0.001$) whereas no improvement was seen in the control group at the end of the study. The mean plaque score increased by 57.67% ($P=0.001$) in the experimental group compared to 4.56% in the control group. The gingival index increased 49.90% ($P=0.001$) in the experimental group. This study concluded that oral health education is effective in increasing oral hygiene knowledge, attitudes and behavior towards plaque control(Subedi *et al.*, 2021).

Research on health promotion programs in schools was also carried out by (Vineetha Karuveetil 1, S Vijay Kumar 1, Chandrashekar Janakiram 1, 2020) whereby curriculum-based health education interventions adapted to different age groups were found to be effective in improving oral health behavior and dental caries experience among school children in India. Schools that have less active dental School program have no relationship with the status of dental caries and dental and oral hygiene status in students in several elementary schools and the equivalent as well as schools that have inactive dental school program have no relationship with status of dental caries and dental and oral hygiene status in students in several elementary and equivalent schools in Makassar city. Indonesia (Nurwiryana 2018) Not all dental health programs in schools are successfully implemented. Optimal community dental and oral health status can be achieved by increasing promotive–preventive efforts from early childhood to old age. The healthy paradigm prioritizes promotive-preventive efforts in addition to curative-rehabilitative efforts (Geetha Priya *et al.*, 2019).

CONCLUSION

Dental health education programs conducted in schools can reduce plaque scores in children 6-12 years old.

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Cite This Article: Naning Nur Handayatun, Ummi Kalsum, Evita Anggereini, Muhammad Rusdi (2024). Meta-Analysis: Effectiveness of Dental Health Education with Plaque Control in Children 6-12 Years Old. *EAS J Dent Oral Med*, 6(3), 57-64.
