



ORIGINAL ARTICLE

Effectiveness of oral health education intervention among female primary school children in Riyadh, Saudi Arabia

Hassan Suliman Halawany^{a,b,*}, Abid Al Badr^a, Salwa Al Sadhan^a,
Mashaiel Al Balkhi^a, Nassr Al-Maflehi^a, Nimmi Biju Abraham^b,
Vimal Jacob^b, Gehan Al Sherif^b

^a Department of Periodontics and Community Dentistry, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

^b Dental Caries Research Chair, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

Received 28 March 2016; revised 17 February 2017; accepted 17 April 2018
Available online 4 May 2018

KEYWORDS

Behavior;
Children;
Education;
Intervention;
Knowledge;
Oral health

Abstract *Objective:* This study aimed to examine the effectiveness of oral health intervention on the improvement in knowledge and self-reported oral health behavior among 6–8 year old female primary school children in Riyadh, Saudi Arabia.

Materials and methods: The sample consisted of 1661 girls in primary schools who are 6 to 8-year-olds (first, second and third graders). The children's level of knowledge was assessed by a self-administered questionnaire that was formulated for this specific age and divided into two parts; oral health knowledge and self-reported oral health behavior. There were seven multiple choice questions and one true/false question with five underlying parts in the questionnaire which contained basic information about oral health knowledge, oral hygiene practices and certain habits that affect teeth. The questionnaires were distributed before and six weeks after implementation of the oral health educational program to measure the level improvement of knowledge regarding oral health among these children.

Results: All the questions showed statistically significant improvement in knowledge and self-reported behavior in the post intervention group. There was a significant increase in the level of knowledge by 11.24% and level of self-reported behavior by 25% after intervention ($P < 0.001$).

* Corresponding author at: Dental Caries Research Chair, College of Dentistry, King Saud University, P.O. Box 60169, Riyadh 11545, Saudi Arabia.

E-mail address: Hhalawany@ksu.edu.sa (H.S. Halawany).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

The highest net change in the knowledge due to intervention was noted among third graders (13.3%), whereas for self-reported oral health behavior, it was noted among first graders (28.3%).

Conclusion: The results of this study showed that an easy-to-organize and inexpensive school-based intervention can, on a short-term basis, be effective in improving the knowledge and self-reported oral health behavior of children.

© 2018 Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

The improvement of oral health literacy, implementation of behavioral changes and maintenance of good oral health are fundamental objectives of oral health-education (OHE) programs (Kay and Locker, 1996). Schools, in conjunction with their educational commitments, is the most appropriate setting for conducting health-education programs as opportunities to promote public health goals in a large population of children which can be achieved at a very low expense (Kwan et al., 2005).

Different educational interventions have been used varying from the simple delivery of information to more complex programs involving psychological and behavior change strategies. Knowledge, attitudes, behaviors, intentions, beliefs, use of dental services and oral health status and adoption of healthier lifestyles have all been targeted for change as a result of these interventions, which has stood the test of time as dentistry's most pioneering testimony towards concern with the prevention of oral diseases (Kay and Locker, 1996).

Dental health education can result in enhancement of objective measures of oral health status and behaviors although it may be less effective in changing attitudes and knowledge (Brown, 1994). It helps dentists reach schoolchildren's families and community influencing their attitudes and behaviors at a formative stage (Habbu and Krishnappa, 2015). School OHE can be provided by means of professional instructions using charts, posters, brochures, leaflets, models, audio-visual aids, or PowerPoint presentations (Gambhir et al., 2013). Although pediatric OHE materials like leaflets are readily available, their quality and readability vary widely (Arora et al., 2014).

Several studies have reported positive outcomes of OHE interventions in terms of oral cleanliness (Yazdani et al., 2009), significant changes in oral health behaviors (Reinhardt et al., 2009), brushing skills (Livny et al., 2008), caries control regimens (Tolvanen et al., 2009), plaque and gingival scores (Shenoy and Sequeira, 2010, De Farias et al., 2009, Zanin et al., 2007) and also in the incidence of dental caries, improved oral hygiene and established positive oral health practices (Tai et al., 2009).

Therefore, we designed and supervised a preliminary school-based intervention oriented research project, implemented by undergraduate dental students of King Saud University, Riyadh, Saudi Arabia. The project evaluated how a structured school-based intervention program could improve changes in knowledge and self-reported oral health behavior of children. This study aimed to examine the effectiveness of OHE intervention on the improvement in the knowledge and self-reported behavior among 6–8 year old female primary school children in Riyadh, Saudi Arabia.

2. Materials and methods

2.1. Study design and setting

This cross-sectional study was ethically approved by the College of Dentistry Research Centre (CDRC; Registration Number: FR0301) at King Saud University in Riyadh, Saudi Arabia. The city of Riyadh comprises of a complex and diverse population of various origins, thereby representing the urban area of the Saudi Arabian peninsula. As such it was an appropriate region to study the effect of school based intervention among children in Saudi Arabia. Due to the rules and regulations in the Kingdom of Saudi Arabia which segregate genders in all levels of education, this study included only primary school girls. At the time of the study, in the city of Riyadh, the total number of schoolgirls studying at 436 government schools were 1,91,731 and 259 private schools were 49,361. The framework of the study was conceptualized in the beginning of 2014. During this stage, the study protocol was produced, the questionnaire was designed and school visits were planned. Consequently, three groups were formed, two groups of six students and one group of seven giving a total of 19 undergraduate female dental students. These 19 dental students, under the supervision of 6 faculty members of the Department of Periodontics and Community Dentistry, visited a total of 8 government primary schools for implementing this study. Government schools were targeted primarily due to the convenience of obtaining the permission from a single government organization, the Ministry of Education (MOE). Moreover, we assumed that children studying in the government schools would be less exposed to dental health education programs as they may be having less access to dental care either due to economic reasons, priority reasons or negligence. The official permissions from the school authorities were sought after explaining the objectives of the study before the commencement of the study and materials needed for the study implementation were prepared in December 2014. The fieldwork for the study was carried out from February to March 2015.

2.2. Method of selecting sample

At $\alpha = 0.05$ with estimated standard deviation = 2.5 score, power = 0.96 (Probability of type II error = 0.04) and effect size = 0.7, the sample size required for each group will be at least 530 female school children. Government schools from low to middle socioeconomic status were chosen in Riyadh city. The locality and neighborhood surrounding the school helped us in identifying the socioeconomic status of the selected government schools. We included first to third class groups (6–8 years of age children falls under these classes).

Each class group consisted of approximately 50–60 children. The three groups of dental students were able to collect a sample of 588, 670 and 577 school children respectively giving a total of 1835. The children who were absent in the post intervention survey were excluded from the study. Thus, the final sample of primary school children aged 6 to 8 years who participated for both pre and post interventions were 1661.

2.3. Questionnaire

The children's level of knowledge was assessed by a self-administered pictorial questionnaire that was formulated for this specific young age by the research team. Pre-testing of the questionnaire was carried out by initially administering the questionnaire to 60 children in one of the government schools, 20 female children from each of the three class groups were selected. We obtained feedback from participants on any difficulty faced by them in interpretation of the questions and any ambiguity within responses was checked. The questionnaire comprised of seven multiple choice questions and one true/false question with five underlying parts in the questionnaire which contained basic information about oral health, oral hygiene practices and certain habits that affect teeth. The questions included the following: the number of permanent teeth, healthy/unhealthy food that affect teeth, frequency and duration of tooth brushing per day, frequency of periodic dental check-ups per year, fluoride and finally the importance of teeth and the habits that affected them. The multiple-choice questionnaire was distributed before and six weeks after implementation of the OHE program to measure the level of improvement of knowledge and self-reported behavior regarding oral health among these children.

2.4. Oral health intervention

The OHE program was in the form of a four minute animation video, a lecture presentation, and finally four educational corners. All three parts of the program covered all topics in the questionnaire and emphasized on the following three messages (brushing teeth twice per day, healthy diet and regular dental visit twice per year). After attending the animation video and lecture, the children were divided into groups (a maximum of seven in each group) before going to the educational corners. The concerned class teachers were also present throughout the study to help the research team in co-ordination and behavior management of the children.

The first corner was the brushing corner, in which a demonstration of the Circular brushing technique was performed using a jaw model and a tooth brush. Also, the importance of fluoride, the frequency and duration of brushing teeth every day were emphasized. The second corner was the healthy diet corner, where children were informed about what healthy and unhealthy foods are and how they affected the teeth. The third corner was the periodic dental visit corner, where educators informed the children about the importance of these visits, showed them different examination instruments, how topical fluoride is applied in the dental clinic and taught them the number of times they should visit the dentist per year. Teeth models were used to teach the children about the different types of teeth, the function of each type, and finally the number of teeth in primary and permanent dentition.

Once the children passed through all these corners, they moved to the fourth corner where they received a bag containing an educational booklet intended for the child and another one for the parent, a brushing chart and toothbrush (medium bristled) and fluoridated toothpaste kit. As part of the prepared educational material, posters including all these messages were distributed in all participating schools to remind the children of how to care for their teeth.

2.5. Statistical analysis

The data obtained from the survey were manually entered into a Statistical Package for the Social Sciences database (IBM, SPSS version 20, IL, USA) and were analyzed using repeated measurement analysis with $P < 0.05$ set as the level of significance. Among the 12 questions used in the study, 9 were categorized as knowledge-based questions and 3 as behavior-based questions. The mean score of knowledge and self-reported behavior regarding oral health and the mean overall score was calculated. One-way ANOVA repeated measurement analysis using Greenhouse-Geisser within group test and Wilks' Lambda between group tests were used to measure the impact of educational intervention on the level of knowledge and self-reported oral health behavior. Paired t test was used to analyze the association between the pre- and post-intervention responses in each question within the class groups. Post Hoc tests were used to analyze the association between the study classes. The net effect of the intervention program was estimated by subtracting the mean difference in the pre- and post-intervention in each class groups.

3. Results

The demographic characteristics of each of the three classes at pre- and post-intervention were similar as we deliberately excluded the dropouts of 174 school children. Among a total of 1661 female respondents, there were 573 first graders, 565 second graders and 523 third graders.

Percentage responses to the oral health knowledge based questions by class of study and among pre- and post-intervention is given in [Table 1](#). A statistically significant difference was noted between the post-intervention responses for all class groups compared to the baseline response to the question regarding the total number of permanent teeth and their perception of fluoride as an anti-cariogenic component of toothpastes and the importance of teeth for speaking ($p < 0.05$). Significantly more number of second graders reported milk and water as beneficial drinks for the teeth (98.1%) and perceived eating as an important function of teeth (89.0%) in the post intervention group compared to the baseline ($p < 0.05$). The question related to the importance of teeth for smiling were similar among the groupings ($p > 0.05$). Following the intervention, significant differences were found among the third graders in relation to not using teeth for biting objects.

Percentage responses to the three key oral health behavior questions by class of study and among pre- and post-intervention is given in [Table 2](#). Post-intervention, significantly more number of children in all class groups reported brushing their teeth at least twice daily and visiting the dentist twice a year compared the baseline groups ($p < 0.05$). Regarding the time needed for brushing teeth, significantly higher number

Table 1 Percentage responses to the oral health knowledge based questions by class of study and among pre- and post- intervention.

Correct answers	First graders		Second graders		Third graders	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Total number of permanent teeth = 32	37.2	59.0 ^a	41.9	54.0 ^a	38.2	64.6 ^a
Drinks beneficial for the teeth = Water or milk	96.0	97.6	94.9	98.1 ^a	96.6	97.9
Food good for teeth = fruits and vegetables	99.1	99.0	99.5	99.5	99.4	99.8
Anti-cariogenic component of toothpaste = fluoride	36.0	74.3 ^a	46.0	83.4 ^a	47.6	89.1 ^a
Importance of teeth for smiling = yes	99.0	98.8	98.2	98.2	99.4	99.6
Importance of teeth for nail biting = no	94.1	92.7	95.9	97.2	96.4	98.1
Importance of teeth for eating = yes	89.7	89.2	79.1	89.0 ^a	79.3	88.7 ^a
Importance of teeth for speaking properly = yes	62.3	75.7 ^a	59.5	66.2 ^a	66.5	77.6 ^a
Importance of teeth for object biting = no	92.0	91.6	93.3	94.3	92.9	96.2 ^a

^a p value < 0.05: significant difference between pre- and post-test in each grouping, within class of study; paired *t* test.

Table 2 Percentage responses to the oral health behavior based questions by class of study among pre- and post- intervention.

Responses	First graders		Second graders		Third graders	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Brush teeth at least twice per day	83.5	91.0 ^a	86.0	92.0 ^a	94.2	96.0 ^a
Visit to the dentist twice per year	67.2	86.5 ^a	62.2	81.0 ^a	57.5	85.6 ^a
Brush teeth for 2 min	55.5	80.9 ^a	66.3	79.4 ^a	63.4	80.6 ^a

^a p value < 0.05: significant difference between pre- and post-test in each grouping within class of study; paired *t* test.

of first graders in the post-intervention group (80.9%) reported brushing for 2 min compared to the other groups (*p* < 0.05).

Mean scores and net effect of intervention for oral health knowledge and self-reported behavior are given in [Tables 3 and 4](#) respectively. Overall, the knowledge score at baseline was 7.10 ± 1.10 and after intervention (6 weeks later), the mean knowledge score was 7.90 ± 1.03. There was a significant increase in the level of knowledge (*P* < 0.001) by 11.24% after intervention. The level of knowledge was higher after the intervention compared to the baseline scores and this difference between the groups was statistically significant (*p* < 0.05). The highest net change in the knowledge due to intervention was noted among third graders (13.3%).

Overall, the self-reported behavior score at baseline was 2.04 ± 0.81 and after intervention (6 weeks later), the mean score was 2.55 ± 0.66. There was a significant increase in the

self-reported behavior score (*P* < 0.001) by 25% after intervention. Although the self-reported behavior scores were higher after the intervention compared to the baseline scores among the class groups, this difference between the groups was not statistically significant (*p* > 0.05). The highest net change in the self-reported oral health behavior due to intervention was noted among first graders (28.3%).

4. Discussion

This paper reports on how a low-cost simple school-based education intervention program, results in changes in the knowledge and self-reported oral health behavior of school children. The most important target of intervention strategies is the alteration of personal behavior from health damaging

Table 3 Mean score and percentage change in responses to the oral health knowledge based questions, pre- and post- intervention according to class groups.

Groups	Time	n	Mean	SD	95% CI		Difference	Net effect of intervention (% change)	P-value within group [*]	P-value between groups ^{**}	
					Lower	Upper					
Total	Overall	Pre	1661	7.10	1.10	7.05	7.15	0.80	11.24	0.000	0.000
		Post	1661	7.90	1.03	7.85	7.95				
Female	Grade 1 ^a	Pre	573	7.05	1.12	6.96	7.14	0.73	10.29	0.000	0.008
		Post	573	7.78	1.11	7.69	7.86				
	Grade 2 ^a	Pre	565	7.08	1.10	6.99	7.17	0.72	10.09	0.000	
		Post	565	7.80	1.02	7.71	7.88				
	Grade 3 ^b	Pre	523	7.16	1.07	7.07	7.26	0.95	13.29	0.000	
		Post	523	8.12	1.90	8.03	8.20				

% change calculated by using the mean values of pre and post interventions (i.e. Post – Pre/Pre * 100).

^{*} One way ANOVA of repeated measurement: Greenhouse-Geisser test *p*-value (within group test).

^{**} One way ANOVA of repeated measurement: Wilks' Lambda test *p*-value (between group tests).

^{a,b} Different superscript letters indicate significant difference by Post Hoc tests.

Table 4 Mean score and percentage change in responses to the oral health behavior based questions, pre- and post- intervention according to class groups.

Groups	Time	n	Mean	SD	95% CI		Difference	Net effect of intervention (% change)	P-value within group*	P-value between groups**	
					Upper	Lower					
Total	Overall	Pre	1661	2.04	0.81	2.22	2.31	0.51	24.93	0.000	0.000
		Post	1661	2.55	0.66	2.23	2.32				
Female	Grade 1 ^a	Pre	573	1.98	0.82	2.31	2.41	0.56	28.26	0.000	0.269 (NS)
		Post	573	2.54	0.70	1.92	2.05				
	Grade 2 ^b	Pre	565	2.04	0.85	2.49	2.60	0.47	23.09	0.000	
		Post	565	2.51	0.65	1.97	2.11				
	Grade 3 ^a	Pre	523	2.11	0.75	2.46	2.56	0.50	23.57	0.000	
		Post	523	2.61	0.63	2.04	2.18				

% change calculated by using the mean values of pre and post interventions (i.e. Post – Pre/Pre * 100).

* One way ANOVA of repeated measurement: Greenhouse-Geisser test p-value (within group test).

** One way ANOVA of repeated measurement: Wilks' Lambda test p-value (Between group tests).

^{a,b} Similar superscript letters show significant differences by Post Hoc tests.

to health promoting (Kuusela et al., 1997). There are a wide variety of environmental and circumstantial factors that influence change in individual behavior and attitudes towards a healthy lifestyle. The consideration of only a certain aspect of change in terms of behavior as the ultimate goal of health education may be inadequate (Habbu and Krishnappa, 2015). According to the suggestions made by Nutbeam (1998) evaluation of oral health promotion interventions comprises of four levels: health promotion action (e.g., education), health promotion outcomes (e.g., health literacy), intermediate health outcomes (e.g., health behavior), and lastly, health and social outcomes (e.g., plaque score). Certain subset of these aforementioned levels were utilized in this study.

In the present study it was found that there was increase in the overall knowledge score which was similar to the Brazilian study conducted among schoolchildren (De Farias et al., 2009). It was observed that almost all of the children displayed an ardent interest to learn and were well entertained during the interactive presentation of the oral health program. It is noteworthy that the intervention program was found to be effective in improving oral health knowledge and self-reported oral health behavior in the short span of 6 weeks. This finding is in agreement with other studies that found that oral health behavior and attitude of primary school children temporarily improved irrespective of the educational approach that was performed (Angelopoulou et al., 2015, Reinhardt et al., 2009, Friel et al., 2002, Tai et al., 2001). On the other hand, few studies, reported no improvement when using the traditional methods (Hart and Behr, 1980, Anaise and Zilkah, 1976) which is in contrast to the findings of the present study. These findings, as advocated in the past, prove that OHE should be repetitive in order to sustain its constructive results longitudinally (Angelopoulou et al., 2015, Hart and Behr, 1980).

The increase in adoption of the self-reported habit of brushing twice daily for at least 2 min and in the interest of visiting the dentist twice yearly are good progresses that can be attributed to the intervention program. These positive outcomes may result in a reduction in the incidence of caries in the intervention arm when compared with the control arm, as reported by Esan et al. (2015). Unfortunately, this study did not mea-

sure the caries profile of participants nor did we have a control group with no intervention, which may be considered as a major drawback of this study. During the intervention phase, toothbrushes (medium bristled) and fluoridated tooth pastes were distributed among the children to motivate them toward active participation in the program. The fact that the provision of toothbrushes for school children in the intervention arm of the study may have contributed to the rise in the frequency of tooth brushing up to twice daily should not be overlooked. However, we cannot readily clarify the reasons for these observations. As the next phase of planning begins, further study and understanding of the reasons for these findings are necessary.

At the end of the study, children seemed to have improved their knowledge about the cause and prevention of tooth decay. Their self-reported increase in the brushing habits and intention of frequent dental visits as compared with the baseline, reflects their newly gained knowledge or expected behavior which is reported by several other studies as well (Shenoy and Sequeira, 2010, Yazdani et al., 2009, Saied-Moallemi et al., 2009, Vanobbergen et al., 2004, Honkala et al., 2002, Worthington et al., 2001, Redmond et al., 1999, Nyandindi et al., 1996, Nyandindi et al., 1994). This study in Riyadh was their first OHE experience at school and the children may have found the new idea interesting. This also can be described as an 'exposure effect' whereby altering children's oral health knowledge and behavior by mere exposure to a dentist's presence and a questionnaire formulated according to their age with appropriate pictures (Chapman et al., 2006).

Moreover, incidence of caries needs to be assessed in order to measure the effects of these intervention outcomes. In the future, these intervention programs could be reinforced with involvement of parents in the educational process and other preventive measures such as tooth brushing and fluoride treatment in order to boost its effect. In general, the affirmative effects of educational programs on oral health are believed to be short-lived, with apparent benefits perceived shortly after the program that fade at later visits (Honkala et al., 2002). The sustainability of the findings, therefore, remains unpredictable, a limitation identified in a study regarding OHE (Watt and

Marinho, 2005). However, it has been reported that improvements in terms of decrease in plaque and gingivitis following oral health interventions were maintained for at least 3.5 years following its termination (Schou, 1985). Thus, whether the transformation in observed behavior is persistent even after cessation of the study intervention needs to be evaluated.

According to a communication-behavior change model (Tengland, 2012), OHE programs centered on an information persuasion strategy have a positive influence on individuals' knowledge and behaviors. The behaviors of individuals are vulnerable to change when exposed to health promoting educational messages written on pamphlets (McGuire, 1984). School-based preventive programs should be given a high-priority by health policymakers in Saudi Arabia. Further research is, however, needed to establish the long-term benefits of oral health interventions with different age groups, educational aids and providers.

Several limitations of this study need to be addressed. Because the study population only included female school children from Riyadh, Saudi Arabia, the findings obtained from these self-reported data can only be generalized within this population. It is possible that children irrespective of the gender from other geographical regions may respond differently to the questionnaire used in this study. The cross-sectional design, lack of control group without intervention and the short time period between pre- and post-test to bring about a substantial change may be considered as other limitations of this study.

In conclusion, the results of this study showed that an easy-to-organize and inexpensive school-based intervention can, on a short-term basis, be effective in improving the knowledge and self-reported oral health behavior of children. An oral health intervention with a wider scope involving the oral health providers, the school personnel, children and their parents needs to be attempted to see what effect it could have on the oral health of school children in Saudi Arabia.

Acknowledgements

The authors wish to extend their appreciation to the Deanship of Scientific Research, King Saud University at Riyadh, Saudi Arabia for financially supporting this research. The authors also wish to thank the school authorities and the children for their kind participation.

Conflict of interest

The authors of this study confirm that there are no known conflicts of interest associated with this publication.

References

- Anaise, J.Z., Zilkah, E., 1976. Effectiveness of a dental education program on oral cleanliness of schoolchildren in Israel. *Community Dent. Oral Epidemiol.* 4 (5), 186–189.
- Angelopoulou, M.V., Kavvadia, K., Taoufik, K., Oulis, C.J., 2015. Comparative clinical study testing the effectiveness of school based oral health education using experiential learning or traditional lecturing in 10 year-old children. *BMC Oral Health* 15, 51.
- Arora, A., Lam, A.S., Karami, Z., Do, L.G., Harris, M.F., 2014. How readable are Australian paediatric oral health education materials? *BMC Oral Health* 14, 111.
- Brown, L.F., 1994. Research in dental health education and health promotion: a review of the literature. *Health Educ. Q.* 21 (1), 83–102.
- Chapman, A., Copestake, S., Duncan, K., 2006. An oral health education programme based on the National Curriculum. *Int. J. Paediatr. Dent.* 16 (1), 40–44.
- De Farias, I.A., De Araujo Souza, G.C., Ferreira, M.A., 2009. A health education program for Brazilian public schoolchildren: the effects on dental health practice and oral health awareness. *J. Public Health Dent.* 69 (4), 225–230.
- Esan, A., Folayan, M.O., Egbedade, G.O., Oyedele, T.A., 2015. Effect of a school-based oral health education programme on use of recommended oral self-care for reducing the risk of caries by children in Nigeria. *Int. J. Paediatr. Dent.* 25 (4), 282–290.
- Friel, S., Hope, A., Kelleher, C., Comer, S., Sadler, D., 2002. Impact evaluation of an oral health intervention amongst primary school children in Ireland. *Health Promot. Int.* 17 (2), 119–126.
- Gambhir, R.S., Sohi, R.K., Nanda, T., Sawhney, G.S., Setia, S., 2013. Impact of school based oral health education programmes in India: a systematic review. *J. Clin. Diagn. Res.* 7 (12), 3107–3110.
- Habbu, S.G., Krishnappa, P., 2015. Effectiveness of oral health education in children - a systematic review of current evidence (2005–2011). *Int. Dent. J.* 65 (2), 57–64.
- Hart, E.J., Behr, M.T., 1980. The effects of educational intervention parental support on dental Health. *J. Sch. Health* 50 (10), 572–576.
- Honkala, S., Honkala, E., Rimpelä, A., Vikat, A., 2002. Oral hygiene instructions and dietary sugar advice received by adolescents in 1989 and 1997. *Community Dent. Oral Epidemiol.* 30 (2), 124–132.
- Kay, E.J., Locker, D., 1996. Is dental health education effective? A systematic review of current evidence. *Community Dent. Oral Epidemiol.* 24 (4), 231–235.
- Kuusela, S., Honkala, E., Rimpelä, A., Karvonen, S., Rimpelä, M., 1997. Trends in toothbrushing frequency among Finnish adolescents between 1977 and 1995. *Community Dent. Health* 14 (2), 84–88.
- Kwan, S.Y., Petersen, P.E., Pine, C.M., Borutta, A., 2005. Health-promoting schools: an opportunity for oral health promotion. *Bull. World Health Organ.* 83 (9), 677–685.
- Livny, A., Vered, Y., Slouk, L., Sgan-Cohen, H.D., 2008. Oral health promotion for schoolchildren - evaluation of a pragmatic approach with emphasis on improving brushing skills. *BMC Oral Health* 8, 4.
- Mcguire, W.J., 1984. Public communication as a strategy for inducing health-promoting behavioral change. *Prev. Med.* 13 (3), 299–319.
- Nutbeam, D., 1998. Evaluating health promotion-progress, problems and solutions. *Health Promot. Int.* 13 (1), 27–44.
- Nyandindi, U., Milén, A., Palin-Palokas, T., Robison, V., 1996. Impact of oral health education on primary school children before and after teachers' training in Tanzania. *Health Promot. Int.* 11 (3), 193–201.
- Nyandindi, U., Palin-Palokas, T., Milen, A., Robison, V., Kombe, N., 1994. Oral health knowledge, attitudes, behaviour and skills of children entering school in urban and rural areas in Tanzania. *Public Health* 108 (1), 35–41.
- Redmond, C.A., Blinkhorn, F.A., Kay, E.J., Davies, R.M., Worthington, H.V., Blinkhorn, A.S., 1999. A cluster randomized controlled trial testing the effectiveness of a school-based dental health education program for adolescents. *J. Public Health Dent.* 59 (1), 12–17.
- Reinhardt, C.H., Lopker, N., Noack, M.J., Rosen, E., Klein, K., 2009. Peer teaching pilot programme for caries prevention in underprivileged and migrant populations. *Int. J. Paediatr. Dent.* 19 (5), 354–359.
- Saied-Moallemi, Z., Virtanen, J., Vehkalahti, M., Tehranchi, A., Murtomaa, H., 2009. School-based intervention to promote preadolescents' gingival health: a community trial. *Community Dent. Oral Epidemiol.* 37 (6), 518–526.
- Schou, L., 1985. Active-involvement principle in dental health education. *Community Dent. Oral Epidemiol.* 13 (3), 128–132.

- Shenoy, R.P., Sequeira, P.S., 2010. Effectiveness of a school dental education program in improving oral health knowledge and oral hygiene practices and status of 12- to 13-year-old school children. *Indian J. Dent. Res.* 21 (2), 253–259.
- Tai, B., Du, M., Peng, B., Fan, M., Bian, Z., 2001. Experiences from a school-based oral health promotion programme in Wuhan City, PR China. *Int. J. Paediatr. Dent.* 11 (4), 286–291.
- Tai, B.J., Jiang, H., Du, M.Q., Peng, B., 2009. Assessing the effectiveness of a school-based oral health promotion programme in Yichang City, China. *Community Dent. Oral Epidemiol.* 37 (5), 391–398.
- Tengland, P.A., 2012. Behavior change or empowerment: on the ethics of health-promotion strategies. *Public Health Ethics* 5 (2), 140–153.
- Tolvanen, M., Lahti, S., Poutanen, R., Seppä, L., Pohjola, V., Hausen, H., 2009. Changes in children's oral health-related behavior, knowledge and attitudes during a 3.4-yr randomized clinical trial and oral health-promotion program. *Eur. J. Oral Sci.* 117 (4), 390–397.
- Vanobbergen, J., Declerck, D., Mwalili, S., Martens, L., 2004. The effectiveness of a 6-year oral health education programme for primary schoolchildren. *Community Dent. Oral Epidemiol.* 32 (3), 173–182.
- Watt, R.G., Marinho, V.C., 2005. Does oral health promotion improve oral hygiene and gingival health? *Periodontology* 2000 37 (1), 35–47.
- Worthington, H.V., Hill, K.B., Mooney, J., Hamilton, F.A., Blinkhorn, A.S., 2001. A cluster randomized controlled trial of a dental health education program for 10-year-old children. *J. Public Health Dent.* 61 (1), 22–27.
- Yazdani, R., Vehkalahti, M.M., Nouri, M., Murtomaa, H., 2009. School-based education to improve oral cleanliness and gingival health in adolescents in Tehran. Iran. *Int. J. Paediatr. Dent.* 19 (4), 274–281.
- Zanin, L., Meneghim, M.C., Assaf, A.V., Cortellazzi, K.L., Pereira, A. C., 2007. Evaluation of an educational program for children with high risk of caries. *J. Clin. Pediatr. Dent.* 31 (4), 246–250.