Original Article

Impact of Oral Health Education on Oral Health Knowledge of Private School Children in Riyadh City, Saudi Arabia

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Abstract

Aims and Objectives: To assess the early effect of oral health education on oral health knowledge of primary and intermediate school students of private schools by utilizing pre/post questionnaires data from oral health educational projects in Riyadh city, Saudi Arabia. Second, to examine topic-specific knowledge differences between genders, nationalities, and educational levels of the students.

Materials and Methods: Cross-sectional oral health educational data of private school students (n = 1279) in primary and intermediate levels were extracted from the King Salman Centre for Children's Health (KSCCH) projects undertaken by Riyadh Colleges of Dentistry and Pharmacy. Student's pre- and post-test data were analyzed for changes in oral health knowledge. Overall knowledge score and topic-specific knowledge scores were calculated and the differences between gender, nationality, and educational level were examined using Mann–Whitney U-test. Pre/post change in the oral health knowledge was evaluated by Wilcoxon's sign rank test.

Results: Immediately, after oral health educational session high knowledge score category showed an increase of 25.6%, medium and low knowledge score categories showed −3.2% and −22.3% decrease, and this change was statistically significant ($P < 0.001$). Comparison of correct responses between pre- and post-test showed statistically significant ($P < 0.05$) increase in all the questions except for the timing of tooth brushing. Females, non-Saudi nationals and students in primary level of education showed significantly high mean knowledge ($P < 0.001$) at posttest assessment.

Conclusion: Primary and intermediate private school student's overall, and topic-specific oral health knowledge improved immediately after educational intervention provided by KSCCH. High knowledge gain was observed among female non-Saudi primary school students.

Keywords: *Impact, knowledge, oral health education, school*

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Introduction

According to new definition developed by the FDI World Dental Federation oral health is multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex. Further attributes consider oral health as fundamental to health, quality of life and is influenced by the individual's changing experiences, perceptions, expectations, and ability to adapt to circumstances.[1]

Dental caries remains one of the most common childhood diseases in Saudi Arabia, and it is considered as a major

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public health problem among children.[2-4] In spite of the improvement in health-care sector, past few decades have shown secular trends toward increase in Decayed Missing Filled tooth (dmft/DMFT) and caries prevalence rates.[5] Apart from dental caries, studies have also reported the prevalence of oral injuries, dental plaque accumulation, and gingival disease, malocclusion, temporomandibular disorders among children and adolescents in Saudi Arabia.[6-9]

Poor oral health can have adverse effect on children's performance in school, and later, it may affect their self-esteem and accomplishments in life. In addition, children with poorer oral health were more likely to suffer dental pain, miss school, and show underperformance in school. Oral disease can lead to loss of more than 50 million school hours annually.[10-12] Hence, oral health of the children should be given utmost priority while considering community programs in Saudi Arabia.

Knowledge refers to the capacity to obtain, retain, and use information; a mixture of comprehension, experience, judgment, and skill.[13] It is apparent that individuals with strong knowledge of oral health exhibit better oral care practice.[14] Further studies have shown that correct oral health education can help to inculcate good oral health-care practices.[15] According to Stillman-Lowe, oral health education refers to "any learning activity which aims to improve individuals" knowledge, attitudes, and skills relevant to their oral health.[16]

King Salman Centre for Children's Health (KSCCH) and Riyadh Colleges of Dentistry and Pharmacy (RCsDP) jointly provided numerous school educational programs in Riyadh city with an aim to improve the health and oral health knowledge of various community groups. To provide such educational programs school children were considered as a priority group. These educational programs have a mechanism of before and after evaluation of oral health knowledge through identical questionnaires. Numerous educational projects were carried out in government and private primary and intermediate schools for the first time. The extent of the knowledge change as a result of oral health educational programs undertaken in private primary and intermediate school children has not been reported until now.

Hence, the aim of this study was to assess the early effects of oral health education on oral health knowledge of primary and intermediate school students of private schools by utilizing pre/post questionnaires data from oral health educational projects in Riyadh city, Saudi Arabia. Second, to examine topic-specific knowledge differences between genders, nationalities, and educational levels of the students.

Material and Methods

Ethical approval

Study proposal submitted to the research center of RCsDP and ethical approval was obtained. Concerned school authorities and students were given prior information about the educational project and informed consent to participate in the project was obtained. The study was registered with the registration number FPGRP/43548002/15.

Program participants

The program participants consisted of primary and intermediate school students aged 8–15 years, who have attended the oral health educational session the first time between academic year 2013–2014 s semester and 2015 first semester conducted in private schools in Riyadh city Saudi Arabia.

Instrument utilized in the evaluation of oral health knowledge

The knowledge assessment tool for the oral health education (OHE) evaluation was a questionnaire developed based on the WHO information series on school health.[17]

Questionnaire development and validation

After an initial draft of the questionnaire was designed in English, it was validated in 2 steps. First, the study instrument was sent to community project ambassadors of RCsDP and specialists from dental public health and periodontology background to give their expert opinion with regards to its importance and simplicity. English questionnaire was translated into local Arabic language by two bilingual experts in English and Arabic by forward and backward translation method. Second, a pilot study was carried out by selecting a sample of school children (n = 30) who gave their opinion on making questionnaire simpler and shorter. Students from both government and private schools were selected for the pilot study. Amendments from the students were implemented into the questionnaire without affecting the consistency of published literature. Questionnaire was field tested to make sure it is user-friendly and reflects the knowledge gains accurately. Pilot testing showed a Cronbach's alpha value of 81.5%, suggesting adequate reliability of the questionnaire.

Contents of the questionnaire

After extensive discussion by community project ambassadors of RCsDP questionnaire was adopted for evaluation of school oral health educational projects. Questionnaire was made-up of 18 multiple-choice questions with each question having a single correct answer.

Questionnaire consisted of six sections; Section I personal information (age, gender, nationality, educational level, and school type), Section II (structure, functions and types of the teeth), Section III (diet and caries), Section IV (tooth brushing related information), Section V (oral and general health relations), and Section VI (consequences loss of teeth and orthodontic knowledge).

Pretest questionnaire administration

On the day of the school visit, the dental interns administered the pretest questionnaire to the participants before the education sessions. Dental interns and the school teacher were present at all times with the students for needed help. After students had finished all pretest questionnaires were collected and stored in a large envelope. The pretest provided a baseline measure of each participant's oral health knowledge.

Oral health education presentation

Children were given 30 min of powerpoint presentations, and oral health educational movie was also displayed using computer and projector within the auditorium of the school. An interactive learning session was also held before the end of the program. Powerpoint presentation and oral health educational movie were prepared in line with the topics covered in the questionnaire.

Posttest questionnaire administration

At the end of the session, the same participants took the post-test on the same questionnaire utilizing a protocol similar to the pretest questionnaire. All the pre- and post-test data were collected and submitted to the internship quality assurance office of RCsDP for further encoding and analysis.

Data extraction procedure

Internship quality assurance office of RCsDP collects and stores the data-related oral health educational projects in its data bank. Permission to use the OHE data for the purpose of this project had previously been obtained from director internship quality assurance office of RCsDP. From this databank, only data pertaining to primary and intermediate school students studying in private schools was retrieved.

Inclusion criteria

Before conducting any statistical analyses, 2200 case records of the participants were screened for missing values. Cases with any unfilled demographic information, empty responses to the questions, and data related to the government schools were excluded from the analysis. Primary and intermediate students from private schools for whom both pre- and posttest results available were only included in the final analyses [Figure 1].

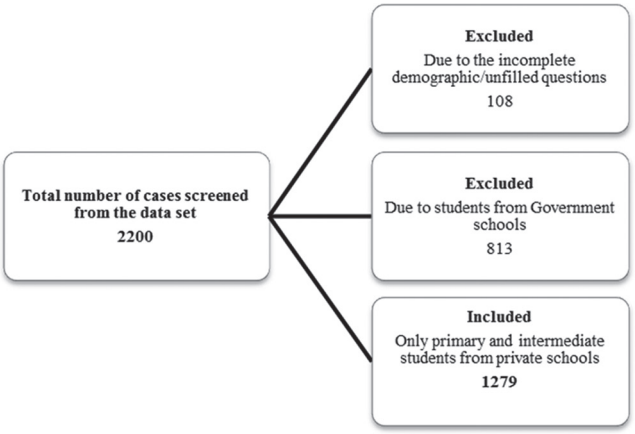

Figure 1: Selection of the study participants in final analysis

Minimum required sample size

Minimum required cases of 377 cases was calculated based on 5% margin of error, 95% confidence interval, assuming response distribution of 50 and keeping population size of 20,000. Sample size calculation was carried out using online Raosoft® sample size calculator. However, to increase the power of the study total cases of 1279 were considered after applying inclusion criteria.

Statistical analysis

Normality distribution of the data: Shapiro–Wilk's test showed nonnormal distribution of the data; hence, a nonparametric Wilcoxon's signed rank test was used to determine the overall knowledge differences between the pre-scores and posttest scores. Overall knowledge changes were also assessed by age, gender, nationality, and educational level.

Overall knowledge Assessment

Each of the 18 multiple choice questions had a single correct answer. All questions had a binary outcome which was coded as one for correct and zero for incorrect. Every correct answer in pre/post was scored 1 and wrong answers were scored zero. An overall composite score was then created, by adding the individual scores on each question. The highest possible overall score was 18, and the lowest possible score was 0 as shown in Table 1.

Following this, the overall score was categorized into low, medium or high based on the number of correct responses. The low category included those participants who had an overall score of 9 or less, medium included those with an overall score of 10–14, and the high category included those individuals with composite scores of 15–18. Percentages for the low, medium, and high category were obtained for both pre- and post-tests. The percentage change was then calculated by subtracting the pretest percentage from the posttest percentage.

Topic-specific knowledge

Topic-specific knowledge assessment involved testing participants' knowledge in definitive areas of the oral health questionnaire. For example, there were several questions on the test about tooth brushing; correct answers on the posttest of these questions indicated that the child gained knowledge in tooth brushing necessary to maintain good oral health [Table 1]. These results helped identify which areas of the oral health were retained by the participants and others which might need further reenforcement. Wilcoxon's sign rank test was then used to assess topic specific changes in knowledge. P <0.05 was used to test statistically significance for overall knowledge change. All of the above analyses were done on IBM-SPSS Version 21 software (Armonk, NY).

Table 1: Specific questions with overall and topic-specific composite scores

Specific question	Score	
	Minimum	Maximum
Section 2: Types, structure and functions of teeth		
Q1. Why do we need teeth?	0	5
Q4. How many sets of dentition we have?		
Q5. How many milk teeth do we have?		
Q6. How many permanent teeth do we have?		
Q15. How many layers are there in tooth?		
Section 3: Dental plaque and caries related questions		
Q9. What does dental plaque mean?	0	5
Q10. What dental plaque can cause?		
Q11. Fizzy drinks affect the tooth adversely?		
Q12. What is the effect of sweet retention on teeth?		
Q13. What is the reason for tooth decay?		
Section 4: Tooth brushing and related questions		
Q2. How many times do you brush every day?	0	5
Q3. Daily when do you brush your teeth?		
Q7. What is the purpose of tooth brushing?		
Q8. At what interval do you change your toothbrush?		
Q14. What are methods to prevent dental caries?		
Section 5: Relationship between oral and general health		
Q16. Does the health of the mouth and teeth impact the health of the body?	0	2
Q17. Does loss of teeth interferes with speech?		
Section 6: Correction of mal-aligned teeth		
Q18. Is it possible to move irregularly placed teeth in to correct position?	0	1
Overall composite score of all questions	0	18

Results

Description of the study population

The highest percentage (21.4%) of the study participants were aged 9 years, followed by 10 years 18.9%. Fifteen-year-old constituted the minor (3.4%) part of the study participants. The male (45.1%) to female (54.9%) ratio was found to be nearly equal. Saudi students (81.6%) and those studying in primary level of education (87.9%) were major component of the study participants as shown in Table 2.

Overall knowledge assessment

Results of the overall knowledge assessment are shown in Table 3. Participants in the high score category (14–18 correct responses) increased dramatically from 7.5% at baseline to 33.1% after the oral health education session a remarkable positive increase of 25.6% was observed. Similarly, number of participants in the medium score category also changed from 51.7% from baseline to the 48.5%. Consequently, there was a decrease in the number of participants who were in the low score category from 40.8% at baseline to 18.5% post-OHE test indicating that a significant number of participants had performed well on the knowledge assessment test after the oral health educational session. The differences in knowledge before and after the

Table 2: Characteristics of the study participants

	n (%)
Age (years)	
8	221 (17.3)
9	274 (21.4)
10	242 (18.9)
11	227 (17.7)
12	140 (10.9)
13	70 (5.5)
14	61 (4.8)
15	44 (3.4)
Total	1279 (100)
Gender	
Male	577 (45.1)
Female	702 (54.9)
Total	1279 (100)
Nationality	
Saudi	1044 (81.6)
Non-Saudi	235 (18.4)
Total	1279 (100)
Educational level	
Primary	1124 (87.9)
Intermediate	155 (12.1)
Total	1279 (100)

intervention were statistically significant ($P < 0.001$) as shown in Table 3.

Total percentage of male (51%) and female (32.5%) study participants in low knowledge score category at pretest level reduced to 25.1% and 13% posttest, respectively. Similarly, percentage of Saudi (42.4%) and non-Saudi nationals (33.6%) in low knowledge score category at pretest level reduced to 19.8% and 12.3%, respectively. Total percentages of primary (39%) and intermediate (54.2%) school study participants in low knowledge score category at pretest level reduced to 16.8% and 30.3% posttest respectively as shown in Table 4. Total percentages of study participants belonging to different gender, nationality, and educational levels in medium knowledge score category changed dramatically from baseline after oral health educational session as evidenced by posttest evaluations. Similarly, percentages of study participants in high knowledge score category increased across different gender, nationality, and educational level from pre- to post-test assessment after oral health educational session as shown in Table 4.

Topic-specific knowledge assessment

Topic-specific analysis of correct answers showed variable responses for different questions. Correct responses ranged from 16.3% to 84.1%, at pretest, before the oral health education was provided. Lowest (16.3%) correct answer was observed for the question what does dental plaque mean? (22.3%) correct response rate was found with the question how many sets of dentition do we have? Followed by the question, how many layers are there in the tooth (27.7%), what dental plaque can cause (28.1%), how many milk teeth do we have (35.8%), what should be the interval for change of toothbrush (40.2%), how many permanent teeth do we have (41%). Similarly, more than half of the correct responses were found with the questions; does the health of mouth and dentition impact the health of the body, why do we need our teeth (63.4%), what is the reason for tooth decay (66.8%), daily when one should brush teeth (70.7%), is it possible to move irregularly placed teeth into correct position (72.7%), can loss of teeth interfere with speech (74.4%), and what is the effect of sweets retention on dentition (74.8). More than two-thirds of correct responses were found with the questions; how many times one should brush every day (76.5%), what is the purpose of tooth brushing (81.6%), soft drinks affect tooth adversely (81.7%), and what are the methods to prevent dental decay (84.1%) as shown in Table 5.

After oral health education percentages of correct responses were increased and this increase ranged from 32.9% to 89.9% as shown by posttest assessment. The lowest posttest correct responses were observed with the question on layers of the tooth (32.9%), followed by other questions; how many sets of dentition we have (37.1%), what should be the interval for a change of toothbrush (45%). More than half of the correct posttest responses were found with the questions; what does dental plaque mean (50.2%), what dental plaque can cause (54.3%), how many permanent teeth do we have (62.2%), how many milk teeth do we have (64%), and does the health of mouth and dentition impact the health of the body (69.8). More than two-thirds of correct answers were observed with questions; daily when one should brush teeth (75.6%), what is the effect of sweets retention on dentition (77.7%), is it possible to move irregularly placed teeth into correct position (80.8%), why do we need our teeth (81.2%), what is the reason for tooth decay (82.3%), how many times one should brush every day (84.2%), what is the

Table 3: Overall knowledge assessment

Overall score categories©	Pretest, *n* (%)	Posttest, *n* (%)	Percentage change	*P***
Low (0-9)	522 (40.8)	236 (18.5)	−22.3	<0.001
Medium (10-14)	661 (51.7)	620 (48.5)	−3.2	
High (14-18)	96 (7.5)	423 (33.1)	25.6	

Number of students in each score category. **Using Wilcoxon sign rank test, ©Number in parentheses refers to the total number of correct answers

Table 4: Demographic variables and oral health knowledge changes among study participants

Category	Test	Gender		Nationality		Educational level	
		Male, *n* (%)	Female, *n* (%)	Saudi, *n* (%)	Non-Saudi, *n* (%)	Primary, *n* (%)	Intermediate, *n* (%)
Low	Pretest	294 (51)	228 (32.5)	443 (42.4)	79 (33.6)	438 (39)	84 (54.2)
	Posttest	145 (25.1)	91 (13)	207 (19.8)	29 (12.3)	189 (16.8)	47 (30.3)
Medium	Pretest	261 (45.2)	400 (57)	526 (50.4)	135 (57.4)	590 (52.5)	71 (45.8)
	Posttest	269 (46.6)	351 (50)	519 (49.7)	101 (43)	517 (46)	103 (66.5)
High	Pretest	22 (3.8)	74 (10.5)	75 (7.2)	21 (8.9)	96 (8.5)	0
	Posttest	163 (28.2)	260 (37)	318 (30.5)	105 (44.7)	418 (37.2)	5 (3.2)

purpose of toothbrushing (84.4%), can loss of teeth will interfere with speech (85.8%), are soft drinks affecting tooth adversely (88.4%), and what are the methods to prevent dental decay (89.9%) as reported in the Table 5. In general, increases in the number of correct responses were observed after oral health educational session. Comparison of correct responses between pretest and posttest showed statistically significant ($P < 0.05$) increase in all the topic-specific questions except for the question related to timing of tooth brushing as shown in Table 5.

Table 5: Topic-specific correct answers by the study participants

	Pretest, n^+ (%)	Posttest, n^+ (%)	P**
Why do we need our teeth?	811 (63.4)	1038 (81.2)	<0.001
How many sets of dentition do we have?	285 (22.3)	474 (37.1)	<0.001
How many milk teeth do we have?	458 (35.8)	819 (64.0)	<0.001
How many permanent teeth do we have?	524 (41.0)	795 (62.2)	<0.001
How many layers are there in the tooth?	354 (27.7)	421 (32.9)	<0.001
What does dental plaque mean?	209 (16.3)	642 (50.2)	0.043
What dental plaque can cause?	359 (28.1)	694 (54.3)	<0.001
Are soft drinks affecting tooth adversely?	1045 (81.7)	1130 (88.4)	0.003
What is the effect of sweets retention on dentition?	957 (74.8)	994 (77.7)	<0.001
What is the reason for tooth decay?	855 (66.8)	1052 (82.3)	<0.001
How many times one should brush every day? (frequency)	979 (76.5)	1077 (84.2)	<0.001
Daily when one should brush teeth? (timing)	904 (70.7)	967 (75.6)	0.051
What is the purpose of tooth brushing?	1044 (81.6)	1079 (84.4)	<0.001
What should be the interval for change of tooth brush?	514 (40.2)	576 (45.0)	<0.001
What are the methods to prevent dental decay?	1075 (84.1)	1150 (89.9)	0.002
Does the health of mouth and dentition impact the health of the body?	704 (55.0)	893 (69.8)	<0.001
Can loss of teeth interfere with speech?	951 (74.4)	1098 (85.8)	<0.001
Is it possible to move irregularly placed teeth into correct position?	930 (72.7)	1034 (80.8)	<0.001

**Using Wilcoxon sign rank test, $^+$Correct responses only

In the present study females, non-Saudi nationals and those students in the primary level of education showed significantly higher mean knowledge ranks ($P < 0.001$) at posttest assessment suggesting improvement in knowledge as shown in [Table 6].

Discussion

The main purpose of this study was to assess the early effects of oral health education on oral health knowledge of primary and intermediate private school students. The present study clearly demonstrated a significant increase in the oral health knowledge among school students as evidenced by an increase in the correct responses after educational intervention. Similarly, topic-specific knowledge also increased significantly after the educational intervention. This finding is similar to the other reported studies among school students in Taiwan, Iran, and Bangladesh.[18-20]

Review by Nakre and Harikiran disclosed that the oral health education is an effective tool in enhancing knowledge, attitude, and practices toward oral health in decreasing plaque accumulation, bleeding gums, and caries increments.[21] Recent systematic review and meta-analysis pointed out that the conventional oral health educational exercises are successful in reducing plaque without diminishing gingivitis. It was observed that there is inadequate evidence in preventing dental plaque-related diseases within the school condition.[22] However, school oral health educational programs have demonstrated successful outcomes in improving knowledge.[23] On contrary, the present study did not evaluate plaque and gingivitis among school children.

In this study, female students showed significantly higher oral health knowledge than their counterpart. This could be attributed to the psychological reason as females show

Table 6: Comparison of posttest oral health knowledge scores among different groups

Groups	n	Mean rank	Sum of ranks	P*
Gender				
Male	577	586.27	338,275.00	<0.001
Female	702	684.17	480,285.00	
Nationality				
Saudi	1044	620.49	647,787.00	<0.001
Non-Saudi	235	726.69	170,773.00	
Educational level				
Primary	1124	668.47	751,361.00	<0.001
Intermediate	155	433.54	67,199.00	

*Mann–Whitney U-test

higher concern toward self-care attitudes, appearance, and self-esteem compared to the male students.[24]

The effectiveness of increased knowledge transforming into actual behavior change is vast. It has been widely accepted that knowledge alone may not necessarily develop positive attitudes or change of behavior. Hence, knowledge in conjunction with other external factors such as family situations, peer influences, local customs and cultural values, social influences, and availability of resources are needed to affect the behavior. Therefore, it is difficult to expect provision of knowledge alone could bring required health gains. Knowledge can be received and retained for many years through well-structured educational programs to influence the behavior.[25,26]

The use of a matched pair pre/post-test design and large sample size were the strengths of the study. The matched pair design permitted for assessment of individual knowledge changes and minimized errors due to potential confounders. In addition, the fairly large sample size provided power to the study. The present study utilized the available secondary data of the educational projects without disturbing the school schedule repeatedly for study purpose.

One of the distinctive limitations of the present study was the absence of a control group and utilization of the secondary data from oral health educational projects. Study did not attempt to measure the transformation knowledge gain into actual behavior changes. There may be the possibility of over or under reporting of the oral health information from the students due to the social desirability. Data extracted for the study purpose were purely from primary and intermediate students studying in private schools of Riyadh city. Hence, generalization of the results to students' population from government schools or any other cities should be done with caution.

Future studies should include strict protocol with control group, reinforcement of oral health education, and periodic evaluation with objective clinical and behavioral outcomes.

Conclusions

Findings of this study revealed that the primary and intermediate private school students overall and topic-specific oral health knowledge improved immediately after educational intervention. High knowledge gain was observed among non-Saudi female primary school children. Therefore, the successful outcome of the KSCCH educational projects should be extended to increase participation and build stronger relationships with the schools.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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