Original Paper

Medical Principles and Practice

Med Princ Pract 2015;24:362–368
DOI: 10.1159/000430096

Received: August 10, 2014
Accepted: April 12, 2015
Published online: June 2, 2015

Long-Term Effects of School-Based Oral Health Program on Oral Health Knowledge and Practices and Oral Health-Related Quality of Life

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Key Words
School health · Community dentistry · Oral hygiene · Oral health · Dental education · Quality of life

Abstract
Objective: To evaluate the effects of exposure to the School Oral Health Program (SOHP) during primary school years on the current oral health (OH) knowledge and practices and OH-related quality of life (OHRQoL) of Kuwait University students. ***Subjects and Methods:*** 300 university students, aged 17.6–24.3 years, completed a validated questionnaire that consisted of 5 sections about demographics, health self-evaluation, OH knowledge and practices and OHRQoL. Of these students, 260 were female, 40 male, 262 single and 38 married. 189 participants had attended the SOHP, while 111 had not. Frequencies and means were used for data description. The Student t test was used to compare the means, while χ^2 analysis was used for the associations between SOHP and non-SOHP attendance. The odds ratios (ORs) were calculated for significant factors. ***Results:*** The SOHP attendees were twice as aware of the relationship between gum problems and heart diseases than the non-SOHP (OR = 2, 95% CI = 1.15–3.48, p = 0.013). The daily activities of the non-SOHP attendees were twice as likely to be affected by dental health issues compared to those of the SOHP attendees (OR = 2.28, 95% CI = 1.41–3.68, p < 0.001). In addition, the SOHP attendees were 3 times as likely to describe their OH status as good/very good/excellent than the non-SOHP attendees (OR = 2.85, 95% CI = 1.31–6.18, p = 0.008). ***Conclusions:*** The SOHP attendees had a better OHRQoL and overall self-satisfaction with their OH than the non-SOHP attendees with insignificant differences between the 2 groups in OH knowledge and practices.

Introduction

Worldwide, oral disease is a major health burden among high-, middle- and low-income populations [1]. Oral health (OH) is a description of the standard of health of oral and oral-related tissues that enables an individual to eat, speak and socialize without active disease, discomfort or embarrassment, and it contributes to the general well-being [2, 3]. Measures of the OH-related quality of life (OHRQoL) provide essential information when assessing treatment needs, making clinical decisions and evaluating interventions, services and programs [4–7]. School-based OH programs were established to overcome the barriers that children and families faced in accessing dental services and to remove inequalities in OH between children in different communities [8–10]. The main aim of community- and school-based OH programs is to improve the OHRQoL of children through OH education, prevention and treatment strategies [3, 8, 11]. Yet,

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the effect of these programs on OH knowledge and practices and OHRQoL after the children leave the schools has not been investigated.

The School Oral Health Program (SOHP) in Kuwait was established in 1983 to provide dental education, prevention and treatment for children between the ages of 6 and 14 years [12], which is consistent with the WHO recommendations about integrating OH services into primary schooling systems [13, 14]. These services are offered both through mobile and fixed clinics at the schools. The program provides preventive and treatment procedures for approximately 300,000 schoolchildren, and approximately 60–70% of them received preventive or therapeutic treatment in 2004 [15]. This represents nearly double the number of the targeted schoolchildren who were treated in 1992 [15]. The effectiveness of the project was evaluated through 4 national OH surveys conducted by the SOHP in 1982, 1985, 1993 and 2001 that determined the OH status of children based on biological measures of the children's OH [12].

Program evaluation is the process of assessing a program's short- and long-term impacts. Historically, OH researchers tended to focus mainly on the biological etiology of dental decay [2]. In recent years, however, more emphasis has been placed on other OH determinants such as OH knowledge and the impact of OH on the quality of life [16]. Most published reports on OH have evaluated either short clinical or health education interventions [8, 13]; however, Cooper et al. [17] advocated for the need to utilize psychosocial theories for a better and more efficient assessment of school-based OH programs [17].

Almost all studies that evaluated the impact of the school-based programs evaluated the effects on children during their involvement in the program, and no studies evaluated the long-term impact of the SOHP on students several years after schooling [8, 17, 18]. Hence, there is a need to evaluate the OH knowledge and practices and the OHRQoL between those who had the chance to attend the SOHP services during their primary school years and those who did not. Therefore, the objective of this study was to evaluate the effects of the SOHP exposure during the primary school years on the current OH knowledge and practices and OHRQoL of Kuwait University students.

Subjects and Methods

Study Population

This is a cross-sectional study among students attending Kuwait University, using a self-administered questionnaire to assess OH knowledge and practices and OHRQoL. The participants were recruited at the Kuwait University Colleges of Social Sciences, Women, Law, Allied Health Science, Pharmacy, Engineering and Petroleum, and Science. Postgraduate, medical and dental students were excluded because these students were expected to have better OH knowledge than those from the other schools and colleges. The study protocol was approved by the Joint Committee for the Protection of Human Subjects in Research, Kuwait, was in full accordance with the Declaration of Helsinki and was presented following the STROBE guidelines.

A representative sample of 300 participants was calculated based on a sampling error of 0.05, using a significance level of 0.1, a proportion of 0.5 and assuming a 90% response rate. The students were randomly selected, and written informed consents were obtained. The questionnaires were distributed in classrooms, student unions and cafeterias of the various schools and collected on the spot until the target total number of questionnaires was achieved. Being a university student was the only inclusion criterion. Completion of the questionnaire took about 7–10 min. The questionnaires were assessed for completeness on-site by the team, and the participants were asked to add any missing or incomplete information.

Study Survey

The questionnaire was developed using previous literature on OH knowledge and practices [19, 20] and self-assessed OHRQoL [19]. The questionnaire included mostly closed-ended questions along with a few open-ended ones. The survey consisted of the 5 sections listed below.

- Demographics: the demographics section had questions about age, gender, marital status, nationality, mother's education level, father's education level, student's field of study, name of primary school, whether the participant's primary school had an OH program and whether the school had a dental clinic.
- OH knowledge: the OH knowledge section consisted of 3 open-ended questions: list 4 dental diseases? Do you know what dental plaque is? (If you do, please define dental plaque.) What are the benefits of fluoridated toothpaste? Also, 6 closed-ended questions about sugar and caries, bacteria and caries, soft drinks and caries, soft drinks and osteoporosis, and the relationship between gum disease and heart problems were asked.
- OH practices: oral hygiene practices included 6 questions on toothbrushing frequency, use of fluoridated toothpaste, last dental visit and the purpose of that visit.
- Health self-evaluation: this section included a question about whether the participant believes that he or she has a dental disease and 2 questions about how the participant assesses his or her oral and general health, with possible responses being 'very poor', 'poor', 'good', 'very good' and 'excellent'.
- OHRQoL: the OHRQoL part was composed of 3 domains of physical, social and psychological impairments. The responses were scored on a scale from 1 to 5 for each item, with 1 meaning 'all of the time' and 5 meaning 'none of the time'.

Data Analysis

Data were coded and entered using Epi Info (version 6.0) and were managed and analyzed using the SPSS 21.0 software (IBM Corp., Armonk, N.Y., USA). For the purpose of analysis, the participants were divided into 2 groups: previous SOHP and non-SOHP attendees. Frequencies were used for the description of demographics, health self-evaluation, OH knowledge and practices

Table 1. Participants' demographics and SOHP attendance

Variables	SOHP (n = 189)	Non-SOHP (n = 111)	Total	p value
Gender				
Female	165 (87.3)	95 (85.6)	260 (86.7)	0.673
Male	24 (12.7)	16 (14.4)	40 (13.3)	
Marital status				
Married	20 (10.6)	18 (16.2)	38 (12.7)	0.157
Single	169 (89.4)	93 (83.8)	262 (87.3)	
Nationality				
Kuwaiti	180 (95.2)	102 (91.9)	282 (94)	0.239
Non-Kuwaiti	9 (4.8)	9 (8.1)	18 (6)	
Type of primary school				
Private	24 (12.7)	33 (29.7)	57 (19)	<0.001
Public	165 (87.3)	78 (70.3)	243 (81)	
Mother's education				
High school or less	63 (33.3)	27 (24.3)	90 (30)	0.100
College or more	126 (66.7)	84 (75.7)	210 (70)	
Father's education				
High school or less	51 (27.0)	27 (34.3)	78 (26)	0.612
College or more	138 (73.0)	84 (75.7)	222 (74)	

Values represent numbers (%). The p values were evaluated by χ^2 analysis.

and OHRQoL. For OH knowledge and OHRQoL, the scores were calculated for the individual questions. Higher scores reflected better OH knowledge and/or OHRQoL. Data normality was tested by the Shapiro-Wilk test, and the t test was applied for the statistical evaluation of the means between SOHP and non-SOHP subjects. The associations between SOHP attendance and OH knowledge, OH practices and OHRQoL were evaluated by χ^2 analysis, and Mantel-Haenszel odds ratios (ORs) were calculated for significant factors.

Results

Demographics

The target of 300 fully completed questionnaires was reached. The basic demographics according to SOHP attendance are given in table 1. A total of 189 (63%) participants were part of the SOHP during their primary school years, while 111 (32%) did not participate. The mean age of the respondents was 19.6 ± 1.6 years (range: 17.6–24.3), of whom 260 (86.7%) were females and 40 (13.3%) males (table 1). 262 (87.3%) respondents were single, and 38 (12.7%) were married. A total of 210 (70%) of the study population reported that their mother had a college education, while 222 (74%) stated that their father had a college education or higher. Of the 300 participants, 243 (81%) studied in public schools, while the remaining 57 (19%) studied in private schools. 135 (45%) students were in nonscientific colleges (College of Social Sciences, College of Women, and College of Law), 33 (11%) were in health-related colleges (College of Allied Health Science, College of Pharmacy), and 132 (44%) were in scientific colleges (College of Engineering and Petroleum, College of Science). The type of primary school was the only demographic variable significantly associated with SOHP and non-SOHP attendance ($p < 0.001$). Children in public schools were 3 times as likely to be enrolled in the SOHP (OR = 2.91, 95% CI = 1.61–5.25) than in private schools.

OH Knowledge

The detailed OH knowledge responses of the participants are shown in table 2. The mean OH knowledge score was 10.8 ± 1.3 points (range: 0–14). A total of 227 (75%) participants listed caries prevention as the function of fluoride in toothpaste. Of the 300 participants, 261 (87%) were aware that sugar causes caries, 216 (72%) that bacteria are not the only cause of caries and 213 (71%) that gum diseases are related to heart problems, 136 (45.3%) that fluoride prevents dental caries in children, 181 (60.4%) that soft drinks cause caries, 104 (36.6%) that soft drinks cause osteoporosis and 77 (25.7%) that parents can transmit bacteria to their children.

The association between OH and SOHP attendance is given in table 3. Regarding the overall knowledge scores, no significant differences were found between the SOHP and the non-SOHP participants ($p = 0.6$), with means of 10.8 ± 1.3 and 10.9 ± 1.4, respectively. None of the knowledge components of the study were significantly associated with SOHP attendance except the relationship between gum problems and heart diseases (table 3). SOHP attendees were twice as likely to be aware that gum problems were related to heart diseases than the non-SOHP attendees (OR = 2, 95% CI = 1.15–3.48).

Oral Hygiene Practices

Of the 300 participants, 219 (73%) had visited the dentist within 1 year, and 60 (27.4%) of them had gone for a dental checkup (table 2); 290 (96.7%) brushed their teeth at least once a day using fluoridated toothpaste. The participants' OH practices are also shown in table 2. None of the studied OH practices were significantly associated with SOHP attendance ($p > 0.05$) (table 3).

Health Self-Evaluation

Of the 300 participants, 81 (27%) reported that they had dental diseases (table 2). However, 270 (90%) evalu-

Table 2. Participants' health self-evaluation, OH practices and OH knowledge

Health self-evaluation	
Do you think you have dental diseases?	
Yes	81 (27.0)
No	144 (48.0)
Don't know	75 (25.0)
How do you evaluate your OH?	
Very poor	9 (3.0)
Poor	21 (7.0)
Good	183 (61.0)
Very good	69 (23.0)
Excellent	18 (6.0)
How do you evaluate your general health?	
Very poor	3 (1.0)
Poor	15 (5.0)
Good	165 (55.0)
Very good	87 (29.0)
Excellent	30 (10.0)
OH practices	
When was the last time you visited a dentist?	
1 year ago	219 (73.0)
2 years ago	26 (8.7)
>2 years ago	55 (18.3)
What was the reason for your visit?	
Pain (emergency)	92 (30.7)
Examination	60 (20.0)
Need for a filling	42 (14.0)
Tooth removal	25 (8.3)
Special treatment: RCT, crowns, braces	81 (27.0)
Do you brush your teeth daily?	
Yes	284 (94.6)
No	16 (5.4)
How many times do you brush your teeth a day?	
<1/day	10 (3.0)
1/day	46 (15.3)
2/day	169 (56.7)
≥3/day	75 (25.0)
Does your toothpaste contain fluoride?	
Yes	234 (78.0)
No	25 (8.3)
Don't know	41 (13.7)
How much toothpaste do you apply on the brush?	
Less than half of the brush	28 (9.3)
Half of the brush	80 (26.7)
More than half of the brush	49 (16.3)
All the brush	143 (47.7)
OH knowledge	
Fluoride is added to the toothpaste for ...	
Pleasant taste	31 (10.3)
Soft feeling	37 (12.3)
Preventing caries	228 (76.0)
Price	4 (1.3)
What oral/dental diseases do you know? Please list	
None	180 (60.0)
1	67 (22.3)
2	45 (15.0)
3	7 (2.3)
4	1 (0.3)
Do you know what dental plaque is?	
Yes	60 (20)
No	240 (80)
If yes, define	–
Sugar is a cause of tooth decay	
Yes	261 (87.0)
No	23 (7.7)
Don't know	16 (5.3)
Bacteria are not the only cause for dental caries[1]	
Yes	216 (72.0)
No	30 (13.3)
Don't know	42 (14.0)
Gum problems are related to heart disease	
Yes	213 (71.0)
No	87 (29.0)
Don't know	–
Fluoride toothpaste prevents tooth decay in babies	
Yes	136 (45.3)
No	46 (15.3)
Don't know	118 (39.4)
Soft drinks cause tooth decay	
Yes	181 (60.4)
No	39 (13.0)
Don't know	80 (26.6)
Soft drinks cause osteoporosis	
Yes	104 (34.6)
No	33 (11.0)
Don't know	163 (54.4)
The father/mother do not transmit bacteria to their children	
Yes	77 (25.7)
No	98 (32.6)
Don't know	125 (41.7)

Values represent numbers (%). RCT = Root canal treatment.
[1] Total n is <300 due to missing data.

ated their OH and general health as good, very good or excellent. The participants' self-evaluation of their oral and dental health is summarized in table 2.

The OH self-evaluation was significantly associated with SOHP attendance (p = 0.008) (table 3). The SOHP attendees were 3 times as likely to describe their OH status as good/very good/excellent (OR = 2.85, 95% CI = 1.31–6.18). The participants' health self-evaluations according to SOHP attendance are summarized in table 3.

Table 3. Associations between OH knowledge, OH practices and health self-evaluation and SOHP attendance

	SOHP (n = 189)	Non-SOHP (n = 111)	p value
OH knowledge			
Fluoride is added to the toothpaste for …			
Caries prevention	147 (77.8)	81 (73.0)	0.347
Price/taste/softener/other	42 (22.2)	30 (27.0)	
Sugar is a cause of tooth decay			
No	27 (14.3)	12 (10.8)	0.388
Yes	162 (85.7)	99 (89.2)	
Bacteria are not the only cause of dental caries			
No	54 (28.6)	30 (27.0)	0.774
Yes	135 (71.4)	81 (73.0)	
Gum problems are related to heart disease			
No	33 (17.5)	33 (29.7)	0.013
Yes	156 (82.5)	78 (70.3)	
Fluoride toothpaste prevents tooth decay in babies			
No	99 (52.4)	66 (59.5)	0.234
Yes	90 (47.6)	45 (40.5)	
Soft drinks cause tooth decay			
No	75 (39.7)	45 (40.5)	0.884
Yes	114 (60.3)	66 (59.5)	
Soft drinks cause osteoporosis			
No	123 (65.1)	75 (67.6)	0.584
Yes	66 (34.9)	36 (32.4)	
The father/mother do not transmit bacteria to their children			
No	135 (71.4)	84 (75.7)	0.424
Yes	54 (28.6)	27 (24.3)	
OH Practices			
When was the last time you visited a dentist?			
1 year ago	135 (71.4)	84 (75.7)	0.423
≥2 years ago	54 (28.6)	27 (24.3)	
What was the reason for your visit?			
Pain (emergency)	54 (28.6)	39 (35.1)	0.235
Other dental procedures	135 (71.4)	72 (64.9)	
Do you brush your teeth daily?			
No	12 (6.3)	6 (5.4)	0.740
Yes	177 (93.7)	105 (94.6)	
How many times do you brush your teeth a day?			
<2/day	39 (20.6)	15 (13.5)	0.121
≥2/day	150 (79.4)	96 (86.5)	
Does your toothpaste contain fluoride?			
No	24 (12.7)	16 (14.4)	0.673
Yes	165 (87.3)	95 (85.6)	
How much toothpaste do you apply on the brush?			
Half of the brush or less	69 (36.5)	36 (32.4)	0.475
More than half of the brush	120 (63.5)	75 (67.6)	
Health self-evaluation			
Do you think you have dental diseases?			
No	123 (65.1)	71 (64.0)	0.845
Yes	66 (34.9)	40 (36.0)	
How do you evaluate your OH?			
Very poor/poor	12 (6.3)	18 (16.2)	0.008
Good/very good/excellent	177 (93.7)	93 (83.8)	
How you evaluate your general health?			
Very poor/poor	9 (4.8)	9 (8.1)	0.239
Good/very good/excellent	180 (95.2)	102 (91.9)	

Values represent numbers (%). p values were evaluated by χ^2 analysis.

Oral Health-Related Quality of Life

The participants' OHRQoL responses are shown in table 4. The mean OHRQoL score was 12 ± 3 points (range: 1–15). The number of participants who never faced any teeth and/or gum problems that affected their daily activities during the 3 months before the study was 151 (50.3%), and 150 (50%) and 162 (54%) participants were not affected by such problems in their social life or self-esteem, respectively (table 4).

The participants' OHRQoL according to SOHP attendance is summarized in table 4. There were no significant differences in the mean OHRQoL between those who went to the SOHP and those who did not (11.8 ± 3.2 and 12.6 ± 2.8, respectively; p = 0.3). Being part of the SOHP was significantly associated with the impact of dental issues on their daily activity (p < 0.001). Non-SOHP attendees were twice as likely to have their daily activities affected by dental health issues compared to the SOHP attendees (OR = 2.28, 95% CI = 1.41–3.68).

Discussion

The present study showed that these Kuwait University students had a good level of OH awareness, an adequate level of practice and good OHRQoL. These findings are similar to previous studies on Kuwaiti adults [20, 21]. Most of the respondents were female, since females are the predominant gender at Kuwait University, and single, since the participants were mainly young (mean age 19 ± 1.6 years) and studied in public schools [12, 14] as previously reported [20].

The 90% good-to-excellent self-evaluation of OH status with acceptable dental attendance rate was >60% according to previous reports from university students [20, 21] at the male Health Sciences Colleges [21] and 43% in the Kuwait University Health Sciences Centre students [20]. These results were also higher than the 39% found in the national health survey done 20 years ago [22]. However, the 33.3% rate of emergency and pain management, in this study, was much lower than the reported 70% among Health Sciences Centre students reported previously [20]. Although this low percentage of emergency visits could indicate some improvement in the OH status of these university students, the dental attendance for checkup/preventive reasons was very low. Equally important in our study, the dental examination as a reason for their visit was lower than reported by Kassak et al. [19] in Lebanon and less than half of the attendance rate among Italian university students [23]. A possible expla-

nation could be that routine dental checkups were not common in Kuwait or regional countries [19]. Hence, there is a clear need to encourage these university students to make routine dental checkup visits, which is normally recommended as part of good OH care [3].

The 81.8% report of brushing ≥2/day in the present study was a substantial improvement over the previously reported 43% for male students at the Health Sciences Colleges in Kuwait [21] and also higher than the 65% among students in Lebanon [19] but lower than the 92% in Italian students [23]. These differences could be due to the general changes in OH knowledge during the last decade [24]. The 86.6% use of fluoridated toothpaste was similar to the previous report by Al-Ansari et al. [21] and that of the Lebanese study by Kassak et al. [19]. Although some improvements have been found in OH practices in Kuwait, more health promotion campaigns are needed for this population to achieve optimal OH, and the university setting can be an ideal environment for such initiatives [24].

Both our study and that of Al-Ansari et al. [21] showed a good level of awareness about the role of sugar and bacteria in the development of tooth decay and of fluoridated toothpaste in the prevention of the disease. A lack of knowledge in some OH aspects was also found in both studies, such as the relationship between soft drinks and tooth decay and the fact that parents/caregivers can transmit their oral bacteria to their child. The majority of the respondents in our study were aware about the relationship between periodontal and heart diseases compared to a lower proportion in the previous report for the male students at the Health Sciences Colleges [21]. It seems that such deficiencies in OH knowledge have not been targeted in OH education and promotion since the study by Al-Ansari et al. [21] 12 years ago. Surprisingly, no significant differences in OH knowledge were seen between the SOHP attendees and the non-SOHP attendees except for the relationship between gum problems and heart disease. A possible explanation could be that other sources of knowledge than the SOHP contributed to the existing knowledge. This knowledge may have been acquired during the primary school years or after graduating high school, and the sources could be parents, a family dentist in private practice or activities done by agencies other than the SOHP.

The OHRQoL of the studied students was relatively higher than that of a previous report of university students in Tanzania [25] as almost 50% of the students reported that their OH status never interrupted their lives, and <5% were severely affected, compared to Tanzanian university students where 51% of the students reported that OH problems affected their daily activities. This reflects the accessibility of the population to OH services in government centers or private practice, which is a very positive point. Although no significant difference was found in the overall OHRQoL between the SOHP and non-SOHP attendees, the daily activities of the SOHP at-

Table 4. Participants' OHRQoL responses and their associations with SOHP attendance and nonattendance

How often have problems with your teeth or gums...	n (%)	p value
During the past 3 months		
affected your daily activities?		
All of the time	13 (4.3)	
Most of the time	20 (6.7)	
Some of the time	53 (17.7)	
A little of the time	63 (21)	
None of the time	151 (50.3)	
affected your social activities?		
All of the time	9 (3)	
Most of the time	29 (9.7)	
Some of the time	49 (16.3)	
A little of the time	63 (21)	
None of the time	150 (50)	
caused avoidance of conversations?		
All of the time	14 (4.7)	
Most of the time	24 (8)	
Some of the time	49 (16.3)	
A little of the time	51 (17)	
None of the time	162 (54)	
affected your daily activities?		<0.001
SOHP		
No	108 (57.1)	
Yes	81 (42.9)	
Non-SOHP		
No	41 (36.9)	
Yes	70 (63.1)	
affected your social activities?		0.282
SOHP		
No	99 (52.4)	
Yes	90 (47.6)	
Non-SOHP		
No	51 (45.9)	
Yes	60 (54.1)	
caused avoidance of conversations?		0.146
SOHP		
No	93 (49.2)	
Yes	96 (50.8)	
Non-SOHP		
No	45 (40.5)	
Yes	66 (59.5)	

tendees were less likely to be affected compared to those of the non-SOHP attendees due to pain and/or functional limitations. This highlights that the impact of the SOHP may extend beyond childhood to affect the participants' lives in adulthood. Such an assumption is confirmed by the very positive self-perception of the OH status observed in the SOHP attendees compared to the non-SOHP attendees.

One of the limitations of this study was that the questionnaire was only distributed to those who could read English. For a wider participation, a translation of the questionnaire into Arabic would be helpful. Another limitation was that the survey did not include a question about where the students had got their OH knowledge, which would have allowed to appropriately evaluate the school-based OH education. Last, there was no clinical examination done to validate the OHRQoL responses.

Conclusion

The SOHP attendance had an extended positive impact on the participants' OHRQoL, especially regarding their daily activities, with an insignificant effect on OH knowledge or practices. Future research with a much higher number of participants to assess the OH status and OHRQoL in the population exposed to a school-based program would give a clearer picture on how the population benefited from these programs in their adult life.

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