

# Oral Health Knowledge and Sources of Oral Health Information among School Children in Qatar

**Research Article**

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Oral diseases present a major public health problem [1]. About 90% of school children world-wide and most adults have experience caries, with the disease being most prevalent in Asian and Latin American countries [2]. Recent research in Qatar showed that caries prevalence is very high (85%) among school children [3]. To overcome the high prevalence of dental caries in Qatar, the need for community-oriented preventive programs is emphasized. Oral health education is an integral part of these programs. Oral health education is believed to be a cost-effective method for promoting oral health if done through schools, where all school children irrespective of their socioeconomic status or ethnicity can be reached [4]. In order to create such oral health education, the assessment of knowledge and attitude is essential [5]. Knowledge means that the individual has all data necessary to understand what oral disease is and how it arises, as well as to understand the protective measures that need to be adopted. This knowledge will, in theory, lead to a change in attitude, which will in turn lead the individual to make changes in their daily life [6]. Thus in the case of dental caries, the individual knows (for example) that incorrect brushing may cause caries, and this information generates a positive attitude towards daily brushing, and thus changes in brushing behavior.

Evidence has showed that an increase in knowledge about risk factors for oral disease and strong knowledge of oral health demonstrates better oral care practices that aim to promote healthy habits [6,7]. Moreover, school children with inadequate

oral health knowledge are twice as likely to have caries as school children with adequate knowledge [4]. Therefore, an effective preventive program is desirable for these school children. However, it is important to evaluate the current status of oral health knowledge before designing an effective prevention program. In parallel with evaluation the current status of oral health knowledge, several researchers clearly identified different sources of oral health information, such as parents, school teachers, dentist, media or relatives, which have a direct influence on the oral health knowledge of school children [8-11], which in turn influences their caries prevalence. Therefore, documentation the primary source of oral health information is needed.

The assumption that oral health education may modify children's oral health knowledge, and consequently change children's oral health behavior, however, is controversial. The decline of dental caries in the United States, across Europe, and Australia during the past years, have been primarily associated with factors such as fluoridated water, fluoridated toothpaste, and the use of sealants [12-17]. Thus, oral health education may not be the main factor associated with the decline in dental caries, but may not be disregarded either. Children must be knowledgeable of not only the causes of oral diseases, but also the current preventive measures to avoid them, such as fluoridation of drinking water [18]. School education programs will enable children to make decisions about oral health regarding their own children in the future or even their community [4]. Therefore, the evaluation of children's oral health knowledge and preventive practices is of great importance. In Qatar, little is known about

the oral health knowledge and sources of oral health information among school children. Hence, the purpose of this study was to assess the existing level of oral health knowledge and sources of oral health information among school children in Qatar in order to carry out an organized school dental health program and allows comparisons with children's oral health knowledge in other nations.

### Materials and Methods

#### Sample size (School selection and children selection within the school)

The research work was carried out between October 2011

and April 2012. The total number of all government and private Intermediate schools in Qatar in the 2011-2012 academic year was 135 [19,20]. This is a descriptive cross-sectional study. A list of all intermediate schools (12-14 year school children) were provided by the Supreme Education Council, 16 schools (8 boys and 8 Girls schools; 12 government and 4 private schools) were randomly selected from different areas (Urban and Semi Urban) within the state of Qatar. This was to ensure an appropriate representation from all segments of the society, keeping in mind the socio-demographic factors (gender, ethnicity, age, area, government or private school) (Figure 1). Because most children are not able to disclose their parent's income reliably, the type of school (government or private) was used as a proxy indicator of the child's economic background.

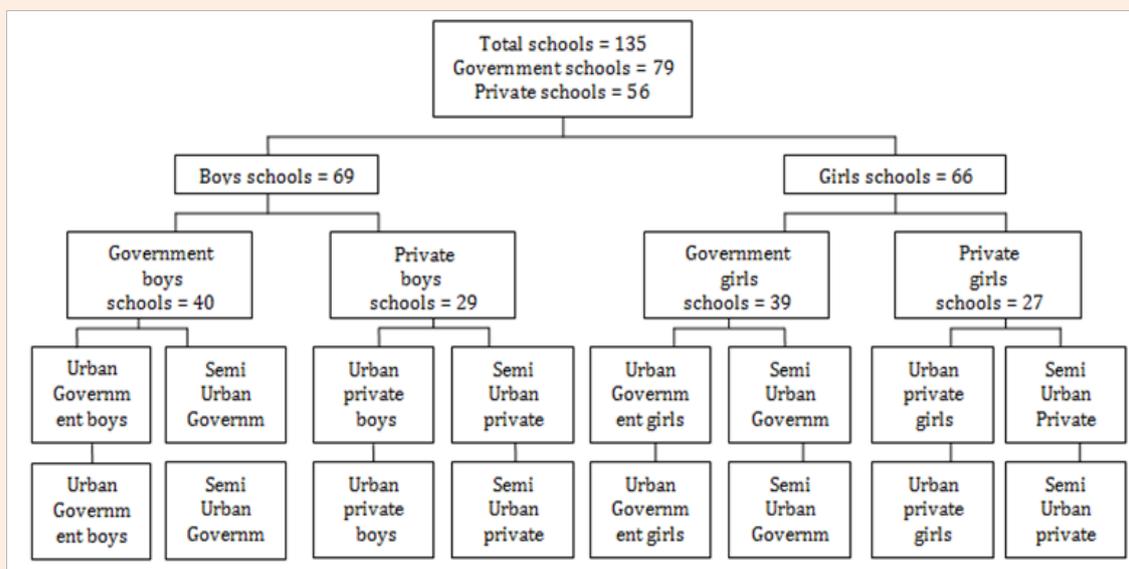


Figure 1: Sampling and inclusion procedure of schools.

The total number of 12-14 year old children (Intermediate school children) in Qatar in the 2011-2012 academic year was 40,440 (20,141 males and 20,299 females) [19,20]. A multistage random sample using the stratified random sample technique with proportion allocation was used to select the sample [21]. In this study 40 children for each age (12, 13, 14 years) in each sampling site (16 schools) were selected (120 children in each sample site X 16 schools = 1920 children). In order to cover of any unexpected problems during the study period, an additional 280 children were added to the 1,920 children. Thus, 2,200 children were selected, which is sufficient to address the objectives of the study. Finally, the classrooms were chosen on a random basis, and all children from the randomly selected classes were invited to participate in the study. Visit permissions and coordination to visit the schools was obtained from the Supreme Education Council and principals of each selected school. The principal of each school was asked to inform the students and their parents about the study, and a day be set for each school to collect the data. The child's age was confirmed from the school registries. School children who are below 12 years or over 14 years were not invited to participate in the study.

### Questionnaire

The approach taken in this research was quantitative, utilizing close-ended questions format in a structured paper and pencil self-administrated survey questionnaire. The questionnaire included twenty two items. Children received a full explanation of how to score their responses and were made aware that for some items, the children were free to choose more than one answer for the same item. Furthermore, the researcher was always available during the completion of the questionnaire, and the children were encouraged to approach him whenever they needed clarification of any point. Care was taken that children did not duplicate each other's answers by asking each child to keep an empty seat between themselves and other child. Also, care was taken that each child completed only one questionnaire, and children answered all the items in the questionnaire. Once the children completed the questionnaire, they were asked to remain in the classroom until all have completed the survey. When everyone had completed the survey, children were able to hand the completed questionnaires to the examiners. In dentistry many survey questionnaires have appeared in the literature claiming

to assess the oral health knowledge [4-8,22-25]. These survey questionnaires vary considerably in content (ranging from 9 to 46 items) and aspects of oral health which they assess (ranging from only knowledge to assessing habits, attitudes, behaviors, and practices).

In line with others, in this study the information about oral health knowledge and its sources of information was collected through a survey questionnaire, which was derived from previously developed and tested questionnaires that are used in pediatric oral health research [5,6,22-25]. The questionnaire was constructed using a systematic multistage process: literature review, validity testing, and consideration to nominate questions for inclusion, revision or elimination from the questionnaire (Figure 2). These processes in questionnaire development were grounded based on the methodological framework for assessing health indices proposed by Guyatt and others [26,27]. The original version of the questionnaire was written in English and had been translated into Arabic. The translation was performed by two independent and expert translators. Finally, another independent translator returned back translations, which were further compared with the originals, and inconsistencies were analyzed and corrected [28]. The questionnaire was designed to be comprehensible for the intermediate school children and was pre-tested among a group of children (Thirty children) who were requested to complete the questionnaire on two different occasions separated by seven days. The pre-test focused on the children's ability to understand the vocabulary used in the questionnaire, and that the questions were clear and unambiguous. The questionnaire was found suitable for application among the 12-14 year old children as there was high concurrence with the answers to the items on both occasions (Kappa test coefficient for all questions = 0.94). Minor changes were made to certain terminology in the questionnaire prior to its administration in the actual survey.

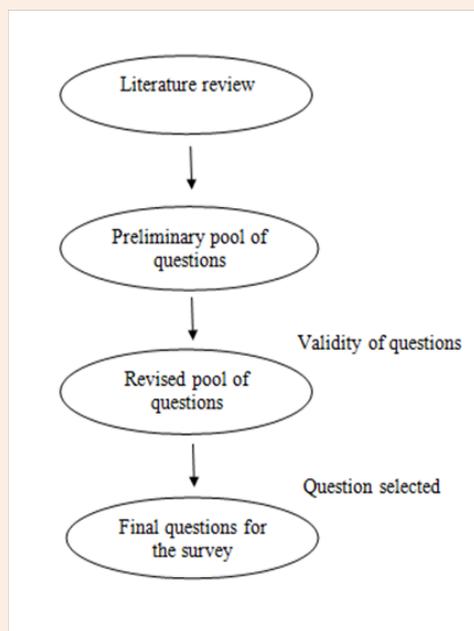


Figure 2: Development of oral health questionnaire.

Consent for participation was obtained prior to enrolment from the parents of all children. Only children with signed parental consent had been enrolled in the study. The questionnaire was distributed in the classrooms and collected after completion. Assessment of children's oral health knowledge included items on the importance of dental health to general health, functions of teeth, frequency of brushing teeth, best brushing aids, attitudes toward regular dental visits, the effects of using fluoride on teeth, signs of tooth decay, symptoms of gum diseases, the ways of keeping gums healthy, and the meaning of plaque and its effects on teeth. The total estimate of oral health knowledge was calculated from responses to the 21 items of the oral health knowledge questionnaire by giving each correct answer 1 mark and each wrong answer given 0 marks, with 21 as the maximum possible score. The score of oral health knowledge scale was constructed based upon the numbers of correct responses. Respondents were stratified in to groups by level of knowledge: low (less than 8 answers correct), medium (8 to 14 correct), high (15 or more answers correct) the higher the score, the better oral health knowledge [22]. Item number 22 in the questionnaire was used to determine the primary source of oral health information.

### Data management and statistical analysis

Once the questionnaire was completed, it was stored securely in a locked file cabinet. The questionnaire charts were reviewed for completeness and clarity before starting data entry into a computer. All data were double entered to assure accuracy. Both entry and double entry of the data were completed by the main researcher. Electronic copies of the data were stored on a password protected computer and only the researchers involved in this study had access to the computer. Regarding the possibility of loss of subject confidentiality, the researchers involved in this study made all possible effort to ensure that the data collected kept confidential. Statistical Package for the Social Sciences version 20 was used to analyze the data (SPSS Inc, Chicago, USA). Descriptive statistics were obtained, and Chi-square test to compare the proportions, was used. Statistical significance was fixed at  $P < 0.05$ .

### Ethical approval

Ethical approvals for the study were obtained from Two organizations: First, the Medical Ethics Committee (Reference number: RC/11660/2011), Hamad Medical Corporation, State of Qatar. Second, the Policy Analysis and Research Office, Supreme Education Council, State of Qatar. Schools that were selected through the sampling procedure were officially informed and assured about the confidentiality of the research findings and of the report. Written consent was taken both from the schools participating in the study and the children with their guardians after explaining the objectives of the study.

### Results

A total of 87 children did not provide complete responses in their questionnaires; they were exempted from the study, while 2,113 completed the study. The 2,113 children represented 5.3% of the total number of 12-14 year old school children in Qatar in the 2011-2012 academic years, which were 40,440 school children.

### Prevalence of and response to the oral health knowledge questionnaire

Children’s responses to the oral health knowledge questions by gender are presented in (Table 1). A great majority, 1,920 (90.9%) of the children were aware that good dental health is important for good general health. More than two-thirds, 1,495 (70.8%) of the children responded that they care about their teeth as much as any part of their body. Most of the children were aware of the importance of the teeth in chewing, talking and appearance 1,768 (83.7%). Almost a majority of the respondents, 2,029 (96%), think it is important to keep teeth clean and 1,754 (83%) knew that clean teeth prevent bad breath, prevent tooth decay, and keep teeth healthy and beautiful. About 1,433 (67.8%) identified that tooth brush, dental floss, and mouth wash all

together are the best cleaning aid. After each meal tooth brushing was observed by a very small group of children, just 78 (3.7%), followed by twice a day, 730 (34.5%), while the majority brushed only once a day, 1,147 (54.3%). About 942 (44.6%) of the children recognized dental floss as a cleaning device for between the teeth, which means that the importance of cleaning between teeth was apparently less well understood, as 845 (40%) of the children thought that cleaning between teeth by using a tooth brush is adequate and 149 (7.1%) don’t know the right way. A large number, 687 (32.5%) of children thought incorrectly that one must visit the dentist only in case of pain in one’s teeth. A great majority, 2,005 (94.9%) of the children knew that sweets (chocolate/candies) could cause tooth decay. However, a large number of children were not aware of the cariogenic potential of soft drinks, 824 (39%), and sweetened milk, 2,067 (97.8%).

**Table 1:** Distribution of oral health knowledge by gender.

Variables	Total	Male	Female	P-value**
	N=2113(%)	n=1125(53.2%)	n=988(46.8%)	
<b>1. Do you Think Good Dental Health is Important for Good General Health?</b>				
Yes	1920 (90.9)	1006 (89.4)	914 (92.5)	0.035
No	67 (3.2)	44 (3.9)	23 (2.3)	
I Don't Know	126 (6.0)	75 (6.7)	51 (5.2)	
<b>2. Do you Care About Your Teeth as Much as any Part of Your Body?</b>				
Yes	1495 (70.8)	736 (65.4)	759 (76.8)	0.001
No	404 (19.1)	268 (23.8)	136 (13.8)	
I Don't Know	214 (10.1)	121 (10.8)	93 (9.4)	
<b>3. What is the Importance of Teeth?</b>				
Chewing	211(10.0)	140 (12.4)	71 (7.2)	0.001
Talking	46 (2.2)	33 (2.9)	13 (1.3)	
Appearance	88 (4.2)	55 (4.9)	33 (3.3)	
All of the Above	1768 (83.7)	897 (79.7)	871 (88.2)	
<b>4. Do you Think it is Important to Keep your Teeth Clean?</b>				
Yes	2029 (96.0)	1056 (93.9)	973 (98.5)	0.001
No	84 (4.0)	69 (6.1)	15 (1.5)	
<b>5. If "Yes" Why Do you Think it is Important?</b>				
To Prevent Bad Breath	72 (3.4)	58 (5.2)	14 (1.4)	0.001
To Prevent Tooth Decay	121 (5.7)	91 (8.1)	30 (3.0)	
To Keep Teeth Healthy & Beautiful	166 (7.9)	120 (10.7)	46 (4.7)	
All of the Above	1754 (83.0)	856 (76.1)	898 (90.9)	
<b>6. Which of the Following is the Best Cleaning Aid?</b>				
Tooth Brush	588 (27.8)	384 (34.1)	204 (20.6)	0.001
Dental Floss	41 (1.9)	30 (2.7)	11 (1.1)	
Mouth Wash	51 (2.4)	39 (3.5)	12 (1.2)	
All of the Above	1433 (67.8)	672 (59.7)	761 (77.0)	
<b>7. Teeth Should be Cleaned at Least:</b>				
Once A Day	1147 (54.3)	571 (50.8)	576 (58.3)	0.001
Twice Daily	730 (34.5)	368 (32.7)	362 (36.6)	
After Each Meal	78 (3.7)	62 (5.5)	16 (1.6)	
Once A Week	158 (7.5)	124 (11.0)	34 (3.4)	

**Table 1:** Distribution of oral health knowledge by gender.(Cont.)

<b>8. The Best Way to Clean Between Your Teeth is to:</b>				
Use A Toothbrush	845 (40.0)	504 (44.8)	341 (34.5)	0.001
Use Dental Floss	942 (44.6)	430 (38.2)	512 (51.8)	
Use Toothpick	177 (8.4)	104 (9.2)	73 (7.4)	
I Don't Know	149 (7.1)	87 (7.7)	62 (6.3)	
<b>9. How often One Must Visit the Dentist?</b>				
Every Three Months	749 (35.4)	373 (33.2)	376 (38.1)	0.001
Every Six Months	537 (25.4)	209 (18.6)	328 (33.2)	
Once a Year	140 (6.6)	101 (9.0)	39 (3.9)	
Only When Pain in Your Tooth	687 (32.5)	442 (39.3)	245 (24.8)	
<b>10. Which of The Following Diet Causes Tooth Decay? *</b>				
Sweet (Chocolate/Candies)	2005 (94.9)	1043 (92.7)	962 (97.4)	0.001
Soft Drinks	1289 (61.0)	656 (58.3)	633 (64.1)	0.007
Fresh Milk	65 (3.1)	44 (3.9)	21 (2.1)	0.018
Vegetables	710 (33.6)	327 (29.1)	383 (38.8)	0.001
Sweetened Milk	46 (2.2)	40 (3.6)	6 (0.6)	0.001
Fresh Fruits	38 (1.8)	34 (3.0)	4 (0.4)	0.001
<b>11. Have You Heard About Fluoride?</b>				
Yes	822 (38.9)	396 (35.2)	426 (43.1)	0.001
No	1291 (61.1)	729 (64.8)	562 (56.9)	
<b>12. What Does Fluoride Do?</b>				
It Makes Teeth White	345 (16.3)	190 (16.9)	155 (15.7)	0.001
It Helps Protect Teeth From Decay	506 (23.9)	222 (19.7)	284 (28.7)	
It Makes Teeth Grow	38 (1.8)	31 (2.8)	7 (0.7)	
I Don't Know	1224 (57.9)	682 (60.6)	542 (54.9)	
<b>13. The Best Way to Get Fluoride is to:</b>				
Have A Dentist Put Fluoride On Your Teeth	302 (14.3)	191 (17.0)	111 (11.2)	0.001
Brush Your Teeth With Fluoride Tooth Paste	594 (28.1)	272 (24.2)	322 (32.6)	
Drink Water That Has Fluoride in it	66 (3.1)	30 (2.7)	36 (3.6)	
I Don't Know	1151 (54.5)	632 (56.2)	519 (52.5)	
<b>14. Which of The Following Can Be a Sign of Tooth Decay?</b>				
Toothache	1174 (55.6)	605 (53.8)	569 (57.6)	0.001
Bleeding Gums	162 (7.7)	112 (10.0)	50 (5.1)	
Calculus	421 (19.9)	257 (22.8)	164 (16.6)	
Cavities In Teeth	356 (16.8)	151 (13.4)	205 (20.7)	
<b>15. I Can Avoid Tooth Decay:</b>				
By Good Dental Hygiene	477 (22.6)	310 (27.6)	167 (16.9)	0.001
By Eating Less Sweets	103 (4.9)	78 (6.9)	25 (2.5)	
By Using Fluoride	91 (4.3)	64 (5.7)	27 (2.7)	
By Going to Dentist Regularly	249 (11.8)	139 (12.4)	110 (11.1)	
All of The Above	1193 (56.5)	534 (47.5)	659 (66.7)	
<b>16. Blood on Your Toothbrush May be a Sign of:</b>				
Gum Disease	1339 (63.4)	622 (55.3)	717 (72.6)	0.001
Tooth Decay	278 (13.2)	198 (17.6)	80 (8.1)	
I Don't Know	496 (23.5)	305 (27.1)	191 (19.3)	

**Table 1:** Distribution of oral health knowledge by gender.(Cont.)

<b>17. Healthy Gums do not Bleed!</b>				
True	1482 (70.1)	742 (66.0)	740 (74.9)	0.001
False	193 (9.1)	121 (10.8)	72 (7.3)	
I Don't Know	438 (20.7)	262 (23.3)	176 (17.8)	
<b>18. Symptoms of Gum Diseases Include:</b>				
Swelling and Redness of Gums	265 (12.5)	173 (15.4)	92 (9.3)	0.001
Bad Smell From Mouth	132 (6.2)	105 (9.3)	27 (2.7)	
Bleeding From Gums	375 (17.7)	242 (21.5)	133 (13.5)	
All of the Above	1341 (63.5)	605 (53.8)	736 (74.5)	
<b>19. The Best Way to Keep Your Gums Healthy:</b>				
Eat a Good Diet	270 (12.8)	152 (13.5)	118 (11.9)	0.226
Clean Your Teeth Everyday	1151 (54.5)	591 (52.5)	560 (56.7)	
Take Vitamins	248 (11.7)	132 (11.7)	116 (11.7)	
I Don't Know	444 (21.0)	250 (22.2)	194 (19.6)	
<b>20. What is Plaque?</b>				
A toothpaste	158 (7.5)	119 (10.6)	39 (3.9)	0.001
A Layer of Germs on the Teeth	776 (36.7)	337 (30.0)	439 (44.4)	
A Plastic Coating for Teeth	157 (7.4)	90 (8.0)	67 (6.8)	
I Don't Know	1022 (48.4)	579 (51.5)	443 (44.8)	
<b>21. Dental Plaque Can Lead to Tooth Decay:</b>				
Yes	761(36.0)	362 (32.2)	399 (40.4)	0.001
No	194 (9.2)	114 (10.1)	80 (8.1)	
I Don't Know	1158 (54.8)	649 (57.7)	509 (51.5)	

Less than half, 822 (38.9%), of the children actually had heard about fluoride and only 506 (23.9%) correctly identified the action of fluoride as preventing tooth decay. Only 66 (3.1%) of the children recognized fluoridated water as a source of fluoride while 1,151 (54.5%) of the children were not aware of any method of getting fluoride. Both toothache and cavities in teeth could be a sign of tooth decay, only 1,174 (55.6%), and 356 (16.8%), respectively, correctly answered the question about the sign of tooth decay. More than half, 1,193 (56.5%), of the children identified that good dental hygiene, eating less sweets, using fluoride, and regularly visiting the dentist all together could prevent tooth decay. About 1,339 (63.4%) thought that blood on the tooth brush could be a sign of gum disease. Also, 1,482 (70.1%) of the children recognized healthy gums do not bleed and only 1,341 (63.5%) correctly identified that symptoms of gum disease include swelling, redness of gums, bad smell from mouth and bleeding from gums. Approximately 1,151 (54.5%) of the children knew that the best way to maintain optimum gingival health was to clean their teeth daily and 444 (21%) did not know. Slightly less than half, 1,022 (48.4%), of the children couldn't define the meaning of plaque and only 761 (36%) could recognize that dental plaque can lead to tooth decay.

In (Table 2), the distribution of socio-demographic

characteristics by oral health knowledge is displayed. For each socio-demographic variable of oral health knowledge, the differences between its categories were significant except age, residential area and type of school (only moderate oral health knowledge). Overall, there were highly significant differences between children with poor oral health knowledge, children with moderate oral health knowledge, and children with high oral health knowledge by all socio-demographic variables except age and residential area. Furthermore, (Figure 3) presents the distribution of the children's oral health knowledge level by age. A higher proportion of the children in all age groups (12-14 years) demonstrated a medium level of knowledge.

### Sources of oral health knowledge

Table 3 and Figure 4 highlight the reported sources of children's information about oral health knowledge. Parents were the most popular, 1,460 (69.1%), source of oral health information for the children followed by dentists, 181 (8.6%), school teachers, 107 (5.1%) and media (television, radio, newspaper; journal), 64 (3%). Very few children reported house maid, 45 (2.1%), and relatives, 37 (1.8%), as the most popular source of oral health information. By gender, although parents were the most popular source of oral health information, however, it was slightly higher for male than female children.

Table 2: Distribution of socio-demographic characteristics by oral health knowledge.

Variable	Oral Health Knowledge						Overall P-Value**
	Poor (0-7) n=235 (11.2) n (%)	P-value**	Moderate (8-14) n=1332(63.0) n (%)	P-Value**	High (15-21) n=546 (25.8) n (%)	P-Value**	
<b>Ethnicity</b>							
Qatari	164 (69.8)	0.004	861 (64.6)	<0.001	268 (49.1)	<0.001	<0.001
Non-Qatari	71 (30.2)		471 (35.4)		278 (50.9)		
<b>Gender</b>							
Boys	190(80.9)	<0.001	757 (56.8)	<0.001	178(32.6)	<0.001	<0.001
Girls	45(19.1)		575 (43.2)		368(67.4)		
<b>Age</b>							
12 year	76(32.3)	0.360*	454(34.1)	0.384*	168(30.8)	0.163*	0.266*
13 year	71(30.2)		435(32.7)		200(36.6)		
14 year	88(37.4)		443(33.3)		178(32.6)		
<b>Type of School</b>							
Public	149(63.4)	0.004	950(71.3)	0.901*	410(75.1)	0.027	0.004
Private	86(36.6)		382(28.7)		136(24.9)		
<b>Area</b>							
Urban	145(61.7)	0.342*	775(58.2)	0.433*	323(59.2)	0.855*	0.590*
Semi Urban	90(38.3)		557(41.8)		223(40.8)		

\*Non significant.

\*\*By Chi-square test.

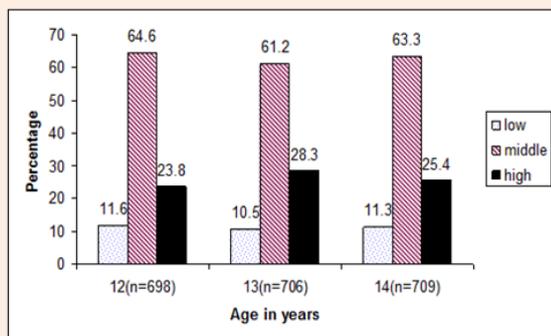


Figure 3: Distribution of children's oral health knowledge level by age.

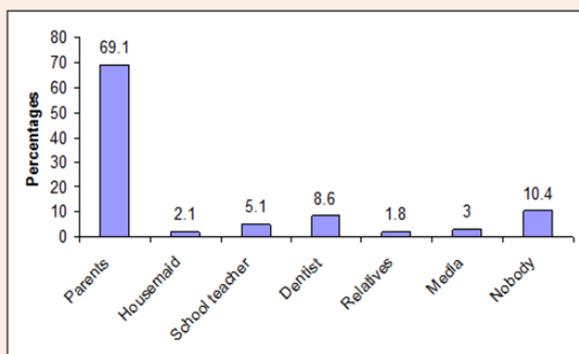


Figure 4: Sources of oral health information.

Table 3: Sources of oral health information by gender.

Variables	Total N=2113 (%)	Male n=1125 (53.2%)	Female n=988 (46.8%)	P-value**
<b>22. Who Taught You how to Clean Your Teeth?</b>				
Parents	1460(69.1)	754(67.0)	706(71.5)	0.027
House Maid	45(2.1)	27(2.4)	18(1.8)	0.358
School Teacher	107(5.1)	58(5.2)	49(5.0)	0.837
Nobody	219(10.4)	119(10.6)	100(10.1)	0.731
Dentist	181(8.6)	110(9.8)	71(7.2)	0.033
Relatives	37(1.8)	24(2.1)	13(1.3)	0.153
Media "Television, Radio, News-Paper, Journal"	64(3.0)	33(2.9)	31(3.1)	0.785

\*\*By Chi-square test.

### Discussion

This study presented a comprehensive overview and information about the level of oral health knowledge among 12-14 year old school children in Qatar. To the best of our knowledge, this study represents the first study of its kind that explored these issues among school children in Qatar.

## Design and methodological issues

In this study, sample calculation and sampling procedures were optimized to ensure that the results of this study could be generalized to all 12-14 year old school children in Qatar, thus minimizing selection bias. The author believe that the sample was sufficiently large enough, including 16 different schools and drawn from economically diverse area to make the study sample reasonable representative of all 12-14 year old school children's in Qatar. Effect on non-response error: Adequacy of response rates may be rated as good (more than 80%), acceptable (70-79%), suspect (55-69%), and unacceptable (less than 55%) [29]. The response rate in this study was good (96%), giving further strength to the validity of the study.

There are a variety of approaches to surveying individuals, each with their particular strengths and weaknesses. The most common approaches include paper and pencil questionnaires in administration room, electronic by distribution of questionnaires via fax or internet, questionnaires delivered by mail, face-to-face interviews, and telephone interviews. The mode of survey administration can have serious effects on the accuracy and quality of the data obtained [30]. Electronic methods restrict the survey to individuals who have access to fax or computer, familiarity with keyboards, do not provide an opportunity for individuals to clarify and understand questions, and also do not provide an opportunity for examiner to ensure that the individuals answer all questions on the form. Moreover, incompatibilities in software or hardware may hinder or prevent a response. When questionnaires delivered by mail, the amount of time needed to distribute and receive answers can be wasted. Also, mailed questionnaires restrict the survey to individuals who can be reached by mail. In personal face-to-face interviews, the participants may not be willing to express their views especially with sensitive questions. Also, face-to-face interviews may create the potential for interviewer to intentionally or unintentionally influence the answers. Telephone methods require access to, or ownership of a telephone and no control for the environment (presence of outsiders affecting responses). Overall, within all previously mentioned modes of administration, there are many potential influences on responses. Thus, for all previous reasons, the paper and pencil self-administrated survey questionnaire in classroom has been used for collecting the data to overcome all disadvantages of the other methods, and also as it is cost effective.

The approach taken in this research was quantitative, utilizing close-ended questions format in a structured paper and pencil self-administrated survey questionnaire. Prior to the questionnaires administration the questions were pre-tested among group of children (thirty children) in order to assess reliability and validity. Two quite different reasons for using close-ended as opposed to open-ended questions have been distinguished in the literatures [31]. First, close-ended questions are more easily analyzed (every answer given a number so that a statistical interpretation more easily assessed). Second, close-ended questions take less time for the researcher to evaluate it. On the other hand, open-ended questions allow respondents to use their own words (use widely divergent terminology), which is difficult to compare the meaning of the response. Also, use open-ended questions may have illegible writing which is technically challenging and time consuming.

## Oral health knowledge

Traditionally, good oral health practice consists of implementation of two broadly defined sets of behavior; first; self-care habits such as dental hygiene, restriction of sugar products, and use of fluoride products, second; utilization of dental services such as regular dental visits, oral health education, and professionally applied preventive measures [32]. In the present research, effort was made to understand the level of oral health knowledge and sources of oral health information among school children in Qatar. Concerning oral health knowledge, not surprisingly, only 546 (25.8%) school children reported a high level (15-21 score) of oral health knowledge. These data reflects that there is a growing chasm between the practice of dentistry in Qatar and the oral health needs of the nation. This could be due to the lack of an organized and systematic oral health education program in the country. Most of the children 1920 (90.9%) had satisfactory understanding of importance of good dental health and information about the functions of teeth, which is similar to other studies done by Al-Omiri et al. [5] on Jordanian school children and Mirza et al. [33] on Pakistan school children. However, a considerable number of children 345 (16.4%) were not aware of all the functions of teeth. Appropriate knowledge about the functions of teeth is likely to enhance dental care among these children. In this study the oral health knowledge levels (poor, moderate, and high) were influenced by socio-demographic factors, notably gender, ethnicity, and type of school. The results are in line with previous reports [6,7,34]. These differences in oral health knowledge levels could be the result of the different educational level between the children [35].

Tooth brushes were the most commonly used oral hygiene aids 588 (27.8%), this is in agreement with findings obtained among children in Saudi Arabia and Kuwait [36,37]. However, the use of dental floss 942 (44.6%) to clean in-between teeth was still not very popular among school children in Qatar as evident in this study. Furthermore, nearly 730 (34.5%) of the children brushed their teeth twice daily, and only 78 (3.7%) brushed their teeth after each meal, compared with 60.5% in Saudi Arabia and 58.3% in India [25,38]. Lack of child oral health education programs in Qatar might explain these findings. In Norway, Austria, Germany, Denmark, and Sweden, 73% - 83% of the children as young as 11 years old brushed more often than once a day [39]. Those who brush their teeth more than once a day by 12 years of age are more likely to continue to do so throughout their teenage years and into adulthood [40]. Children who brushed their teeth less than once per day were meager about 158 (7.5%), the reasons for not brushing were either that the participants had no time or it was simply forgotten. Appropriate knowledge about the frequency of tooth brushing on a daily basis is likely to enhance dental care among these children.

Evidence has showed that brushing alone is not sufficient in cleaning proximal surfaces of teeth, and therefore the use of dental floss have been recommended to further help in preventing both dental caries and periodontal disease [39]. In this study, about 942 (44.6%) of the children recognized dental floss as a cleaning device for between the teeth, which means that the importance of cleaning between teeth was apparently less well understood and school children were unaware that dental floss helps prevent dental diseases. This result indicates that improvement in knowledge toward the use of dental floss is needed and is consistent with other studies [41]. In agreement with the

reports by the WHO [30] and Cheah et al. [24] the majority of the children, 687 (32.5%), visited their dentist only when they had dental pain. This attitude could be explained in terms of fear due to previous negative dental visit experience or negligence of parents. Approximately a quarter of the children, 537 (25.4%), had a regular visit every six months. This could be due to the low awareness of importance of routine dental visits for dental check-ups. This is in contrast to the children in India and China where 71.6% and 73.6% respectively had a regular dental visit every six months [38,42]. In the literature, a consensus has not been reached on the optimum periodicity for an oral examination by a dentist, but at least one contact per year is highly recommended [43]. The children's knowledge about sweets (chocolates/candies) as a cariogenic diet was quite adequate, 2,005 (94.9%). However, only 46 (2.2%) of the children considered sweetened milk as harmful for dental health; requiring appropriate guidance in this area. It was also seen in this study that less than half of the children, 822 (38.9%), had actually heard about fluoride and only 506 (23.9%) correctly identified that fluoride prevents dental caries. Similarly, very few children, 66 (3.1%), recognized fluoridated water as the most efficient source of fluoride. These results are similar to studies carried out in other countries such as Saudi Arabia and Canada [23,44], and indicate the need for the educating of children about the benefits of fluoride to teeth. Fluoride, especially when provided consistently in drinking water or dentifrice, helps maintain more resistance to dental caries that counteracts the effects of acids produced from the bacterial metabolism of dietary carbohydrates [45].

The children's awareness regarding periodontal health was satisfactory in terms of recognizing signs and symptoms of gum diseases, and identifying the best way of preventing gum diseases. Although, some studies have reported unsatisfactory knowledge of periodontal health among school children, [24] the results of the present study were in agreement with several previous studies that showed satisfactory knowledge about periodontal health [4,22-24]. Only 776 (36.7%) children were able to define plaque, and only 761 (36%) recognized that dental plaque can lead to tooth decay. This finding suggests that awareness regarding the harmful effects of dental plaque should be raised.

### Sources of oral health knowledge

The present study found that parents were the most popular, 1,460 (69.1%), source of oral health knowledge information for children; this is in agreement with the findings of Woolfolk et al. [22] Followed by dentists, 181 (8.6%), school teachers, 107 (5.1%), and media, 64 (3%). As children spend most of their daily time with their parents, the optimal way to raise children's dental health awareness would be to furnish accurate information to parents. There is a need, therefore, to increase provision of oral health knowledge information to the parents. In contrast to the study done in Nigeria [46], where the majority of children identified teachers as the most popular source of oral health information. However, in Qatar, unfortunately we should not expect that if we concentrate on parents we will get great results as regards to improvement of oral health knowledge in their children; this is because the majority of households in Qatar have six to seven children [19], while most Western Europe countries have a relatively large number of households with only

one child [47]. The household size may play a role as a barrier to enhance oral health knowledge, as focusing on one child is different to focusing on six to seven children [48,49]. Hence, new studies should address the effects of household size on oral health knowledge program.

Currently, the dental caries prevalence in Qatar is 85% and the mean decayed, missing, and filled teeth (DMFT) values are respectively 4.62 ( $\pm 3.2$ ), 4.79 ( $\pm 3.5$ ), and 5.5 ( $\pm 3.7$ ), for 12, 13, and 14 year-old subjects. It is the second highest detected in the Eastern Mediterranean region [3]. Qatar has not yet developed a system in which routinely regular dental visits are the accepted norm. In addition, an oral health education program has not been launched either [3]. It appears, therefore, that the population needs to be educated about the advantages of regularly visiting a dentist. For oral health to be improved, responsible policymakers would need to develop and implement appropriate oral health promotion and care programs for use in schools and primary healthcare centers. Notwithstanding its strengths and advantages, this study has some limitations, and it is appropriate to discuss the limitation points of the study. First, this research is being evaluated on the basis of responses to the questionnaires and self-reported data. Measurement errors due to misinterpretation of questions and memory errors are subject to occur. To overcome this problem the questions were worded simply and a pilot study was performed. Furthermore, the researcher was always available during the completion of the questionnaire, and the children were encouraged to approach the researcher whenever they needed clarification of any points. Second, in Qatar, children from higher socioeconomic backgrounds generally are likely to be enrolled in private schools as opposed to children from lower socioeconomic backgrounds who attend mainly public schools. Thus, type of school was used as a proxy of socioeconomic backgrounds for the children. Further studies should be undertaken to address more appropriate measures of socioeconomic class inequalities in relation to oral health knowledge, such as parental income and parental occupation. Third, the study design was cross sectional; therefore, a definite cause and effect of low oral health knowledge and oral health practices cannot be established. However, the study gives a possible association of the existing low level of oral health knowledge in the study population with high prevalence (85%) of dental caries which was published in previous research [3].

### Conclusion

Within the limitation of the study, the research highlights the following findings:

- The oral health knowledge in Qatar is below the satisfactory level. Only one quarter (25.8%) of school children reported a high level (15-21 score) of oral health knowledge.
- The majority of children in Qatar exhibited lack of awareness regarding regular teeth brushing, use of dental floss, use of fluoride, and regular dental visits.
- Parents (69.1%) are the most popular source of oral health knowledge for the children followed by dentists (8.6%), school teachers (5.1%) and media (3%).
- The oral health knowledge levels (poor, moderate, and high)

were influenced by socio-demographic factors, notably gender, ethnicity, and type of school.

### Conflict of Interest

I wish to confirm that there is no conflict of interests associated with the publication of this paper and there has been no significant financial support for this work that could have influenced its outcome. I confirm that the manuscript has been prepared by me and that there are no other persons who satisfied the criteria for authorship but are not listed. I confirm that I have followed the regulations of my institutions concerning intellectual property. I understand that the Corresponding Author is the sole contact for the Editorial process. I confirm that I have provided a current, correct email address which is accessible by the Corresponding Author and which has been configured to accept email from (maldarwish@hamad.qa).

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