Oral health behavior and factors associated with poor oral status in Qatar: results from a national health survey

Sohaila Cheema, MBBS, MPH[1]; Patrick Maisonneuve, Dipl.Eng[2]; Mohamed Hamad Al-Thani, MBBS[3]; Al Anoud Mohammed Al-Thani, MBBS[3]; Amit Abraham, MD[1]; Ghanim Ali Al-Mannai, MMedSci[4]; Abdulla Asad Al-Emadi[3]; Walaa Fattah Al-Chetachi[3]; Badria Ali Almalki[5]; Shams Eldin Ali Hassan Khalifa, MSc[3]; Ahmad Omar Haj Bakri[3]; Albert Lowenfels, MD[6]; Ravinder Mamtani, MD[1]

1 Department of Global and Public Health, Weill Cornell Medicine - Qatar, Doha, Qatar
2 Division of Epidemiology and Biostatistics, European Institute of Oncology, Milan, Italy
3 Department of Public Health, Ministry of Public Health, Doha, Qatar
4 Department of Dentistry, Hamad Medical Corporation, Doha, Qatar
5 Primary Health Care Cooperation, Doha, Qatar
6 Department of Surgery, New York Medical College, Valhalla, NY, USA

Abstract

Objectives: Oral health is a crucial determinant of quality of life. We aimed to determine oral health condition and factors associated with poor oral status in the adult national population of Qatar.

Methods: We used data from the World Health Organization supported STEPS (STEPwise approach to Surveillance) Survey conducted by the Supreme Council of Health, Qatar in 2012. A total of 2,496 Qataris (1,053 men, 1,443 women) answered the national survey. The Rao-Scott Chi-Square test was used to analyze oral health characteristics and multinomial logistic regression to assess risk factors.

Results: The self-perceived oral status of approximately 40 percent of respondents was either "average" or "poor" rather than "good." Poor oral status was more often reported by women (OR = 1.93; 95%CI = 1.30-2.80), by older (OR = 3.38; 95%CI = 1.59-7.19) and less educated respondents (OR = 3.58; 95%CI = 2.15-5.96). Other risk groups included people with diabetes (OR = 1.87; 95%CI = 1.24-2.81), smokeless tobacco users (OR = 3.90; 95%CI = 1.75-8.68), or ever tobacco users (OR = 1.66; 95%CI = 1.03-2.67). Oral health status appeared to be independent of diet, BMI status, and history of hypertension. Difficulties and behaviors related to oral health were more frequently reported by women than by men. These included pain ($P < 0.001$), difficulty chewing ($P < 0.001$), and discomfort over appearance of teeth ($P < 0.001$). Participants used toothbrushes, toothpicks, dental floss, and miswak to maintain oral hygiene.

Conclusion: Our results provide evidence that oral health remains a public health concern in Qatar.

Introduction

Oral health is an integral component of the overall general health, self-esteem and quality of life (1). It is a major issue, with an estimated 3.9 billion people suffering from oral disease (2), and 5-20 percent of adults affected with severe periodontitis (3) worldwide. The wide variation in oral health

status worldwide is determined by multiple factors including degrees of oral hygiene, dental programs, oral health awareness in the general population, and accessibility to dental healthcare professionals. Surprisingly, use of healthcare for prevention of oral disease is limited and oral health problems persist in countries who had a very strong wealth growth in the last decades such as Qatar, Saudi Arabia or Kuwait (4-6). Qatar is a high-income country located to the east of Saudi Arabia, in the Arabian Gulf. Its population is currently 2.3 million (7). Approximately 20 percent of the population are native Qatari's and it is this group that was surveyed by the WHO in 2012. The "STEPwise" approach to Surveillance (STEPS survey), designed by the WHO, is an entry point for countries to initiate chronic noncommunicable diseases surveillance activities. The STEPS tool was designed to cover three different levels (or STEPS) of risk factor assessment: STEP 1 for gathering self-reported demographic and behavioral risk factors information by questionnaire, including standardized data on oral health; STEP 2 for collecting physical measurements with simple tests in a household setting; and STEP 3 for taking blood samples for biochemical measurements. The STEPS are built on standard tools to collect standardized data that will allow regional comparison.

The aim of this study was to use 2012 WHO STEPS data to provide information on self-perceived oral health status, oral health symptoms, and oral health behavior of Qatari men and women and to investigate determinants of poor oral health in this population.

Materials and methods

Survey instrument and sampling

We utilized data from a national survey involving a random sample of 2,496 adult Qatari citizens aged 18-64, obtained in 2012 by trained Qatar Supreme Council of Health staff based on the WHO's established method for estimating non-communicable disease prevalence and risk factors, as part of surveillance. The same standardized questions (phrasing of the English version of the questions is reported in the descriptive tables) and protocols have been used in more than 100 countries in all six WHO Regions for monitoring within-country trends and for making comparisons across countries. General details on the survey are available at the WHO website (8) and country specific details are available in a report from the Supreme Council of Health, Qatar (9). Briefly, a two-stage sample design was used, selecting primary sampling units (PSUs) at the first stage and a sample of households within each selected PSU at the second stage. For this, the country has been divided in 603 PSUs which each contain about 60-70 Qatari households according to the 2010 Census

frame. A random sample of 96 PSUs was selected from the Qatari frame of PSUs. In the second stage, 30 households were randomly selected from each selected PSU. Interviewers visited each selected household and identified all survey-eligible individuals. A personal digital assistant device was used to generate a random number to select one individual either male or female from within the household. Only these selected individuals were administered the questionnaire. Two thousand four hundred and ninety-six of the 2850 Qatari individuals selected were interviewed, corresponding to an overall response rate of 88 percent. The main reasons for nonresponse were either the households were empty blocks or there was a refusal to participate in the survey. An Arabic standardized version of the STEPwise data collection forms was used in the survey, gathering:

• Demographic and behavioral risk factors: age, sex, years at school, tobacco and smokeless tobacco use, types of physical activity, sedentary behavior, fruit and vegetable consumption, history of raised blood pressure, history of diabetes, and oral health
• Physical measurements: height and weight, waist circumference, hip circumference, blood pressure
• Blood samples for biochemical measurements: fasting blood glucose, total cholesterol, HDL-cholesterol, LDL-cholesterol, and triglycerides

All the Qatar national STEPwise questionnaires were tested for cultural applicability and sensitivity through word and pilot testing of the questionnaires. Each participant was interviewed at his/her household by trained interviewers. Biomedical tests were conducted upon appointments as they required 12 hours of fasting. Trained nurses performed blood pressure and anthropometric measurements were performed using WHO recommended devices.

This research proposal had been previously reviewed and approved by Qatar Supreme Council of Health. The Office of Research Integrity at Weill Cornell Medicine – Qatar reviewed the proposal for secondary research analysis of those data by the authors and determined that such secondary analysis is exempt from Qatari and American human subject protection regulations and, therefore, did not require further review by an institutional review board.

Statistical methods

Demographic and oral health characteristics of the Qatari population were evaluated and analyzed. The data were weighted using population weights to adjust for age and sex differences between the sample and the national population. Percentages, means and corresponding 95 percent confidence intervals were then calculated using the weighted data. Comparison of percentages across groups of subjects was assessed using the Rao-Scott Chi-Square test.

We summarized and categorized participants' self-perceived oral status as good, average, or poor, based on results of questions regarding individuals' number of residual teeth, a description of the state of their teeth and gum and the use of removable denture: *Poor oral status* was attributed to those reporting "less than 10 teeth" OR "poor/very poor state of teeth" OR "poor/very poor state of gum" OR "wearing any removable denture"; *Average oral status* was attributed to those reporting "10-19 teeth" OR "average state of teeth" OR "average state of gum" AND not previously classified as having poor oral status; *Good oral status* was attributed to those reporting "20 teeth or more" AND "excellent, very good or good state of teeth" AND "excellent, very good or good state of gum" AND "not wearing a removable denture." Other oral health related variables that focused on symptoms (pain) or behaviors (reason for a visit to the dentist, tooth brushing…) rather than status were not included, but association between these variables is described.

We searched for potential factors associated with each separate oral status questions and with our compound oral status variable using multinomial logistic regression, considering two levels of oral status deterioration (average and poor), adjusting models for potential confounders such as age, gender, or education level. Variables considered included body mass index (normal weight/overweight/obese), tobacco smoking (no/yes), smokeless tobacco (no/yes), history of diabetes (no/yes), history of hypertension (no/yes), and dietary factors (frequent/less frequent weekly consumption, based on food-specific cut-off allowing to divide responders in two separate groups of reasonable size) (consumption of fruits, vegetables, whole grain products, refined cereals, legumes, milk and dairy products, fish and seafood, poultry and chicken, lamb and beef, sweets, sugar sweetened beverages, fruit juices, and fast foods).

In our final model, we retained variables that were significantly associated with outcome after adjustment for age and sex.

Data analysis was performed using the Surveyfreq, Surveymean, Surveyreg, and Surveylogistic procedures of the SAS software (version 9.2, Cary NC, USA). All tests were two-sided and P-values <0.05 considered statistically significant.

Results

A total of 2,496 Qataris (1,053 men, 1,443 women) answered the survey. Socio-demographic and oral health characteristics of participants according to gender are given in Table 1. Significant gender specific differences were observed for education, marital status and occupation ($P < 0.001$). Age distribution ($P = 0.21$) and frequency of consanguinity ($P = 0.39$) were similar in men and women.

Qatari men and women reported similar numbers of natural teeth ($P = 0.15$) and similar state of their teeth ($P = 0.12$) and gum ($P = 0.06$), but a higher proportion of women (11.3

Table 1 Socio-Demographic Characteristics of Participants According to Gender

	Total ($n = 2,496$)	Men ($n = 1,053$)	Women ($n = 1,443$)
Age group (years)			
18-29 years	40.1%	39.6%	40.6%
30-39 years	25.7%	27.5%	24.0%
40-49 years	19.5%	17.8%	21.1%
50-59 years	11.1%	11.0%	11.2%
≥60 years	3.6%	4.1%	3.1%
Education			
No formal schooling	5.9%	2.6%	9.1%
Less than primary school	4.2%	2.8%	5.5%
Primary school completed	8.0%	9.0%	7.0%
Preparatory school completed	14.9%	18.1%	11.7%
Secondary school completed	36.9%	37.7%	36.1%
College/University completed	27.6%	25.9%	29.3%
Post graduate degree	2.5%	3.8%	1.3%
Marital status			
Never married	29.8%	30.1%	29.5%
Currently married	63.8%	67.5%	60.2%
Divorced	4.3%	2.2%	6.4%
Widowed	2.1%	0.2%	3.9%
Occupation			
Government employee	49.1%	64.7%	34.0%
Non-government employee	5.6%	8.7%	2.7%
Self-employed	0.9%	1.4%	0.5%
Non-paid	0.1%	0.1%	0.2%
Student	13.4%	11.3%	15.5%
Homemaker	19.9%	0.5%	38.8%
Retired	7.5%	8.8%	6.3%
Unemployed (able to work)	2.6%	3.6%	1.6%
Unemployed (unable to work)	0.2%	0.3%	0.1%
Satisfied (Does not work and not looking for work)	0.5%	0.6%	0.4%
Consanguinity			
No family relationship between parents	58.5%	57.3%	59.8%
Family relationship between parents	41.5%	42.7%	40.2%

percent) than men (7.3 percent) reported wearing a removable denture ($P = 0.01$) (Table 2). Combining information from this set of initial questions we categorized oral status as good, average, or poor. A slightly higher proportion of women than men were classified as having a poor oral status (20.3 percent versus 14.6 percent) but the difference was only marginally significant ($P = 0.06$).

Oral health symptoms are presented in Table 3. More women (48.3 percent) than men (32.7 percent) reported pain

Table 2 Oral Health Status in Qatari Men and Women by Age Group

	Total all ages %	Men all ages %	Women all ages %	P-value	Men					Women				
Questions					18-29 years %	30-39 years %	40-49 years %	50-59 years %	≥60 years %	18-29 years %	30-39 years %	40-49 years %	50-59 years %	≥60 years %
How many natural teeth do you have?				0.14										
No natural teeth	0.8	0.9	0.6		.	0.5	.	5.1	6.4	0.3	0.1	0.2	1.2	9.0
1-9 teeth	2.2	1.7	2.8		1.0	0.1	1.8	6.6	6.3	0.9	0.4	3.4	8.2	22.4
10-19 teeth	11.4	12.8	9.9		8.0	7.3	18.4	25.8	38.7	3.6	9.8	14.7	17.6	36.0
20 teeth or more	85.6	84.5	86.8		91.0	92.1	79.8	62.5	48.6	95.2	89.7	81.6	73.0	32.6
How would you describe the state of your teeth?				0.12										
Excellent	12.8	14.1	11.4		16.6	12.8	12.5	13.0	9.5	15.5	10.8	7.5	7.1	3.4
Very good	31.8	34.6	29.0		35.8	37.9	32.2	27.0	29.5	34.8	27.8	26.3	21.3	6.9
Good	31.0	29.3	32.8		28.3	25.3	36.2	32.2	28.4	27.4	36.5	35.5	40.5	26.4
Average	18.5	17.3	19.7		15.1	19.2	14.7	21.0	28.5	18.2	18.4	21.4	18.7	44.1
Poor	5.3	4.4	6.3		4.3	4.5	3.9	5.4	4.2	4.1	6.1	7.2	10.8	14.3
Very poor	0.6	0.3	0.9		.	0.2	0.5	1.4	.	.	0.4	2.2	1.7	4.9
How would you describe the state of your gums?				0.06										
Excellent	17.5	19.7	15.3		21.3	21.1	18.9	11.8	19.5	17.6	17.9	12.0	9.7	7.6
Very good	32.5	35.0	30.0		37.3	35.4	34.1	34.0	17.5	34.5	26.8	29.1	25.8	16.8
Good	30.0	27.9	32.0		27.3	24.6	27.7	34.6	38.4	27.2	34.1	36.2	38.9	26.3
Average	15.4	14.0	16.7		10.9	15.6	16.2	16.1	17.7	15.2	15.8	15.8	20.4	38.0
Poor	4.0	3.0	5.0		2.7	3.2	3.1	2.6	6.1	5.2	4.1	5.7	4.2	8.1
Very poor	0.6	0.3	0.9		0.6	.	.	0.5	.	0.2	1.3	1.3	1.0	1.8
Do you have any removable dentures?				**0.01**										
No	90.7	92.7	88.7		94.3	93.9	93.6	85.4	84.1	92.1	90.1	86.8	76.8	88.8
Yes	9.3	7.3	11.3		5.7	6.1	6.4	14.6	15.9	7.9	9.9	13.2	23.2	11.2
Oral status*				0.06										
Good	60.8	63.0	58.7		67.6	64.6	64.0	52.5	31.0	66.8	58.1	55.3	48.0	17.7
Average	21.7	22.4	21.1		19.7	23.0	24.8	19.6	42.8	19.5	23.2	21.8	16.9	34.8
Poor	17.4	14.6	20.3		12.7	12.3	11.2	27.9	26.2	13.7	18.7	22.8	35.1	47.5

The questions and responses depict exactly how information was collected in the English version of the survey questionnaire.
***Poor oral status** defined as reporting "less than 10 teeth" OR "poor/very poor state of teeth" OR "poor/very poor state of gum" OR "wearing any removable denture"; **Average oral status** defined as reporting "10-19 teeth" OR "average state of teeth" OR "average state of gum" AND not previously classified as poor for other reason; **Good oral status** as reporting "20 teeth or more" AND "Excellent, very good or good state of teeth" AND "Excellent, very good or good state of gum" AND "not wearing removable denture." *P* < 0.05 shown in bold characters.

Table 3 Oral Health Symptoms and Behaviors in Qatari Men and Women by Age Group

Questions	Total all ages %	Men all ages %	Women all ages %	P-value	Men 18-29 years %	Men 30-39 years %	Men 40-49 years %	Men 50-59 years %	Men ≥60 years %	Women 18-29 years %	Women 30-39 years %	Women 40-49 years %	Women 50-59 years %	Women ≥60 years %
During the past 12 months, did your teeth or mouth cause any pain or discomfort?				**<0.001**										
No	59.4	67.3	51.7		68.0	62.5	68.9	71.3	75.8	50.0	56.5	48.9	57.6	35.4
Yes	40.6	32.7	48.3		32.0	37.5	31.1	28.7	24.2	50.0	43.5	51.1	42.4	64.6
How long has it been since you last saw a dentist?				**<0.001**										
Less than 6 months	41.8	34.1	49.4		36.8	32.5	34.6	27.9	32.6	51.7	50.8	46.9	41.3	56.2
6-12 months	22.8	25.5	20.2		25.4	24.2	29.5	29.0	9.1	20.9	19.9	22.3	17.0	9.8
>1 year but <2 years	14.4	14.6	14.1		12.6	15.6	14.9	16.6	21.7	12.8	15.7	12.6	19.0	11.1
≥2 years but <5 years	11.6	14.4	9.0		15.0	15.4	9.8	14.4	20.9	7.2	8.9	9.6	13.8	11.2
5 or more years	5.4	6.7	4.0		4.3	6.8	8.2	10.3	14.0	3.0	4.1	3.6	7.1	9.4
Never received oral care	4.0	4.7	3.3		5.9	5.6	3.1	1.8	1.7	4.4	0.6	5.1	1.8	2.4
What was the main reason for your last visit to the dentist?				0.46										
Consultation or advice	9.5	10.0	9.0		9.5	10.9	8.5	13.1	6.3	9.7	9.6	8.7	5.9	7.4
Pain or trouble	24.2	23.3	25.0		25.5	24.5	19.3	22.0	16.7	20.7	30.9	23.8	28.5	30.9
Treatment/Follow-up	39.4	39.0	39.8		39.4	38.4	37.7	37.7	47.9	41.2	35.2	41.6	42.5	37.4
Routine check-up	24.2	25.9	22.6		23.4	25.6	33.2	22.2	29.0	25.0	21.3	20.5	20.4	23.7
Other	2.7	1.8	3.6		2.1	0.5	1.3	5.0	.	3.4	3.0	5.4	2.6	0.6
How often do you clean your teeth?				**<0.001**										
Never	1.3	1.7	0.8		2.2	1.7	0.3	2.2	2.6	0.8	.	0.2	2.2	7.6
Once a month	0.4	0.7	0.1		1.4	.	.	1.4	.	.	.	.	0.9	.
2-3 times a month	0.4	0.8	0.1		0.9	0.6	.	2.2	.	0.1	0.1	.	.	.
Once a week	0.6	1.1	0.2		0.8	1.6	1.0	1.4	1.1	0.1	0.4	.	0.9	.
2-6 times a week	1.2	1.6	0.8		0.8	1.9	1.4	1.1	10.9	0.3	1.5	1.0	0.7	0.8
Once a day	22.8	28.0	17.7		30.4	23.3	25.4	34.7	31.3	20.0	11.8	17.2	16.7	40.1
Twice or more a day	73.2	66.0	80.2		63.6	71.0	71.9	57.0	54.1	78.7	86.2	81.4	78.6	51.5
Do you use toothpaste to clean your teeth?				0.29										
No	3.1	3.6	2.5		3.4	3.3	2.4	7.1	4.3	1.5	1.0	2.0	6.4	19.8
Yes	96.9	96.4	97.5		96.6	96.7	97.6	92.9	95.7	98.5	99.0	98.0	93.6	80.2
Do you use any of the following to clean your teeth?														
Toothbrush	96.7	96.1	97.3	0.18	96.7	96.6	97.2	91.1	95.7	97.6	99.3	98.7	94.2	79.1
Wooden toothpicks	24.3	27.7	21.1	0.01	26.3	30.4	27.3	25.9	28.8	14.8	27.3	24.7	23.2	22.2
Plastic toothpicks	9.7	8.5	10.9	0.19	6.0	10.8	11.0	8.5	6.4	9.6	13.9	10.9	11.5	3.3
Thread (oral floss)	27.6	24.0	31.0	0.005	19.5	25.8	33.5	21.3	19.6	24.7	39.7	35.5	32.8	7.2
Miswak	30.6	43.2	18.6	<0.001	45.9	39.7	39.1	44.5	55.1	15.4	15.6	22.1	20.5	54.1
Other	4.1	4.0	4.2	0.85	3.4	6.2	2.9	2.7	3.3	4.3	3.0	4.1	6.3	6.2

Table 3. Continued

Questions	Total all ages %	Men all ages %	Women all ages %	P-value	Men 18-29 years %	Men 30-39 years %	Men 40-49 years %	Men 50-59 years %	Men ≥60 years %	Women 18-29 years %	Women 30-39 years %	Women 40-49 years %	Women 50-59 years %	Women ≥60 years %
Have you experienced any of the following problems during the past 12 months because of the state of your teeth?														
Difficulty in chewing foods	11.7	8.2	15.2	**<0.001**	8.6	5.6	7.0	10.6	20.9	14.5	10.5	16.9	16.5	44.3
Difficulty with speech/trouble pronouncing words	4.1	1.7	6.4	**<0.001**	0.7	2.2	2.8	2.3	2.2	6.7	5.8	5.8	5.4	15.0
Embarrassed about appearance of teeth	7.2	4.5	9.8	**<0.001**	5.0	4.2	4.9	4.3	0.7	10.9	9.1	9.8	7.5	9.1
Avoid smiling because of teeth	5.9	3.4	8.3	**<0.001**	3.9	3.9	2.6	2.4	0.7	9.6	7.0	9.5	3.9	9.1
Sleep is often interrupted	7.1	4.3	9.8	**<0.001**	4.6	5.3	4.4	0.7	4.4	10.0	8.3	13.1	4.9	14.4
Days not at work because of teeth or mouth	4.2	3.0	5.4	**0.03**	4.0	2.8	2.0	2.8	.	6.7	6.7	4.4	1.1	2.1
Difficulty doing usual activities	2.8	1.8	3.8	**0.02**	2.4	1.5	1.8	0.9	0.7	4.3	3.8	4.4	1.5	2.1
Reduced participation in social activities	2.4	1.5	3.4	**0.01**	1.6	1.1	2.9	.	0.7	2.9	3.1	5.5	1.9	2.6
Any of the difficulties listed above	20.5	14.9	26.0	**<0.001**	14.8	14.8	13.1	14.6	24.4	27.6	21.4	27.2	20.7	53.0

The questions and responses depict exactly how information was collected in the English version of the survey questionnaire. P < 0.05 shown in bold characters.

or discomfort with teeth or mouth in the past 12 months ($P < 0.001$). Attendance to a dentist varied also significantly between men and women ($P < 0.001$). Women (69.6 percent) reported having been to a dentist in the last 12 months against 59.6 percent of men ($P < 0.001$), but the main reason for the last visit to the dentist was similar for men and women. About 10 percent went to the dentist for a consultation or advice, 24 percent for pain, 39 percent for treatment, 24 percent for routine check-up, and 3 percent for other reason. Women reported cleaning their teeth significantly more frequently than men ($P < 0.001$). Women were found to clean their teeth 14.2 percent more (80.2 percent versus 66 percent) compared to men in category "twice or more a day" and about 4 percent less than men (2.1 percent versus 6 percent) in "less than daily" category when asked about how often they clean their teeth. Great majority (96.9 percent) of Qataris use toothpaste to clean their teeth. Still, alternate cleaning tools are often reported such as wooden toothpicks (24.3 percent), plastic toothpicks (9.7 percent), dental floss (27.6 percent), or miswak (30.6 percent) a tooth cleaning twig made from the Salvadora persica tree.

Finally, Table 3 also describes a series of difficulties and behaviors related to oral health. All were more frequently reported by women than by men (P-values ranging from 0.01 to <0.001). The most common problem is difficulty in chewing foods (8.2 percent of men versus 15.2 percent of women; $P < 0.001$), embarrassment about appearance of teeth (4.5 percent of men versus 9.8 percent of women; $P < 0.001$), interruption of sleep (4.3 percent of men versus 9.8 percent of women; $P < 0.001$), avoidance of smiling because of teeth (3.4 percent of men versus 8.3 percent of women; $P < 0.001$). Overall 14.9 percent of men and 26.0 percent of women reported some problems due to the state of their teeth ($P < 0.001$).

Most of the oral status characteristics, oral symptoms and oral health behaviors varied also significantly according to age and gender (Tables 2 and 3).

We conducted a multivariable analysis of factors associated with our compound oral status variable (Table 4) and with each separate oral status variable, considering gender, age group, level of education, tobacco smoking, smokeless tobacco use, and history of diabetes. Older age and low education level (less than secondary school) were associated with an increased risk of deteriorated dental status (either "average" or "poor"). Poor dental status was also more likely present in women, in ever tobacco smokers, in smokeless tobacco users, and in those with diabetes (Table 4). Neither body mass index, history of hypertension nor dietary factors resulted associated with dental status at multivariable analysis (data not shown). Similar associations were observed when we considered each aspect of oral status separately: Reduced number of residual natural teeth (<10) was statistically significantly more frequent in women, in older and less educated

Table 4 Characteristics Associated with Oral Status at Multivariate Analysis

			Oral status			
			Average oral status (n = 518)		Poor oral status (n = 445)	
Characteristics	Total survey participants (n = 2,496) %	Good oral status (n = 1,533) %	%	Multivariable OR (95% CI)*	%	Multivariable OR (95% CI)*
Gender						
Men	49.4	51.2	51.0	1.00	41.2	1.00
Women	50.6	48.8	49.0	0.97 (0.65-1.44)	58.8	**1.93 (1.32-2.84)**
Age group (years)						
18-29 years	40.1	44.3	36.2	1.00	30.4	1.00
30-39 years	25.7	26.1	27.3	1.37 (0.95-1.96)	22.6	1.28 (0.88-1.85)
40-49 years	19.5	19.0	20.7	1.24 (0.85-1.80)	19.6	1.21 (0.83-1.76)
50-59 years	11.1	9.2	9.3	0.97 (0.66-1.42)	20.1	**1.97 (1.21-3.21)**
≥60 years	3.6	1.5	6.4	**3.31 (1.58-6.91)**	7.3	**3.30 (1.55-7.03)**
Education						
Less than primary school	10.1	5.2	14.5	**3.24 (2.18-4.81)**	21.6	**3.52 (2.09-5.93)**
Primary/preparatory school	22.8	20.0	27.5	**1.70 (1.21-2.37)**	26.8	**1.59 (1.10-2.30)**
Secondary school or more	67.0	74.8	58.0	1.00	51.4	1.00
Tobacco smoking (cigarettes, cigars, pipe, Shisha, Medwakh)						
No	79.1	79.5	80.2	1.00	76.5	1.00
Yes	20.9	20.5	19.8	0.90 (0.61-1.33)	23.5	**1.64 (1.02-2.64)**
Smokeless tobacco (snuff, Swaika)						
No	97.8	98.6	96.8	1.00	96.1	1.00
Yes	2.2	1.4	3.2	2.14 (0.57-8.03)	3.9	**3.90 (1.75-8.69)**
History of diabetes						
No	55.6	60.2	48.4	1.00	48.6	1.00
Yes	15.0	11.1	17.0	1.43 (0.93-2.20)	26.1	**1.88 (1.25-2.83)**
Unknown	29.4	28.7	34.6	**1.56 (1.03-2.36)**	25.3	1.27 (0.86-1.86)
Teeth cleaning						
Daily	96.0	96.1	97.6	1.00	93.7	1.00
less than daily	4.0	3.9	2.4	**0.50 (0.25-0.98)**	6.3	1.26 (0.65-2.46)

*Odds ratios (OR) and 95 percent confidence intervals (CI) obtained from multivariable ordinal logistic regression model. $P < 0.05$ shown in bold characters.

participants, in tobacco smokers and in diabetics; Use of a removable denture was statistically significantly more frequent in women and in older participants; Poor state of teeth was statistically significantly more frequent in women, in less educated participants, in smokeless tobacco smokers and in diabetics, Poor state of gum was statistically significantly more frequent in women and in moderately educated participants (data no shown).

Finally, we studied the association between self-perceived oral health status and selected oral health symptoms or behaviors (data not shown). Participants with poor oral health status were more likely to have reported pain or discomfort with teeth during the past 12 months ($P < 0.0001$), to have last seen a dentist in the past 6 months ($P < 0.0001$), that the main reason for their last visit to the dentist was either pain or trouble with teeth, gums, or mouth, or treatment ($P < 0.0001$) or experienced problems during the past 12 months because of the state of their teeth, such as difficulty in chewing foods ($P < 0.0001$), difficulty with speech

($P < 0.0001$), being embarrassed about appearance of teeth ($P < 0.0001$), avoiding smiling because of teeth ($P < 0.0001$).

Discussion

The study reveals that the oral self-perceived status of almost 40 percent of respondents was either "average" or "poor" rather than "good." Poor oral status was more often reported by women, by older and less educated respondents, and was associated with tobacco smoking, smokeless tobacco use, and history of diabetes.

These results are in general agreement with those reported in other Middle East countries: Lower levels of education have been associated with deteriorated oral status in Jordan (10) while the association with tobacco exposure has been noted in studies from Kuwait and Jordan (11,12), confirming findings reported both in developing and developed countries from other parts of the world: Low literacy levels and high

tobacco consumption have been associated with poor oral health in India (13) and in the United States (14).

Type 2 diabetes, which is part of the potentially modifiable metabolic syndrome, increases susceptibility to oral disease (15,16). In our study, people with diabetes were nearly twice as likely to have poor oral health status. About 16 percent of the Qatari population have diabetes (17) and the excess of oral problems in diabetics is similar to other high-income countries like the United States (18) and Sweden (19).

Our study results do not show an association between oral status and variables including body mass index, history of hypertension, and dietary factors (consumption of fruits, vegetables, whole grain products, refined cereals, legumes, milk and dairy products, fish and seafood, poultry and chicken, lamb and beef, sweets, sugar sweetened beverages, fruit juices, and fast foods). However, in other published studies poor diet was negatively associated with oral health in Jordan (20), Iraq (21), both of which belong to the Eastern Mediterranean Region and another high-income country like the United States (22,23) with frequency and the amount of sugar consumption being key indicators of poor oral health. Furthermore, in our study there was no association between body mass index and oral health, whereas in Jordan (10) and the United States (24), being obese or overweight was linked to increased rates of gingivitis and periodontitis.

The strength of the study is that data came from a representative randomized National sample. Additionally, data collection followed well-defined criteria from World Health Organization (WHO), which has a long tradition of epidemiological survey methodology and surveillance in oral health (25), and has been already used in other countries (26). The major limitation of our study is that the data was self-reported, without any oral/dental examination or assessment carried out. However, self-reported oral health variables have been shown to be valid and to reflect clinical status in specific studies (27) and have been widely used in population surveys (28). We also proposed a compound definition of oral status based on four distinct outcomes (number of residual natural teeth, state of teeth, state of gum, and use of removable denture). This grouping is not based on previous literature, but we believe that it provides a good summary measure. Analyses of each of its single components show similar associations with the individual risk factors, but we believe the combined summary score provides a more robust measure.

In conclusion, this study provides data on the relation of several risk factors such as gender, age, education, tobacco use, and history of diabetes that have an impact on oral on oral health. This information will help policy makers and healthcare professionals identify subgroups of the Qatari population that could best benefit from oral and dental health initiatives.

Acknowledgments

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