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Determinants of oral-health-related quality of life among adult people in Iran

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ABSTRACT

Background: Oral health-related quality of life (OHRQoL) assesses the subjective perception of oral health and its impact on the quality of life. The aim of this study is to measure the OHRQoL and its determinants among adult people living in Kerman, Iran.

Materials and Methods: In this cross-sectional study, a total of 5657 adult people (18–64 years) residing in the Kerman district, both in the rural and urban areas, were enrolled in the study between September 2014 and April 2018. The Oral Health Impact Profile (OHIP-14) and the oral health indices, such as the total decayed, missing, filled teeth (DMFT), community periodontal index (CPI), gingival index (GI), and xerostomia, were measured by an experienced dentist. The demographic variables of gender, age, educational status, and marital status were also recorded. The impact of the studied variables on OHRQoL was evaluated with multiple logistic regression.

Results: Participants were 2239 (39.58%) men, and average age was 45.39. The mean scores for OHRQoL, DMFT, CPI and GI were respectively: 24.07 (7.76), 10.7 (6.86), 0.76 (0.96), 0.63 (0.8). The frequency of people with xerostomia was 37.4. 301 (53.3%) of people had poor quality of life related to oral health. In multivariable analysis, there was a statistically significant increase in OHRQoL with an increase in the DMFT ($P < 0.001$), xerostomia ($P < 0.001$), CPI, ($P < 0.001$). Men had a significantly higher OHIP score than women ($P < 0.001$).

Conclusion: According to the results of this study, DMFT, xerostomia, and CPI scores are strongly related to OHIP scores. In addition, between CPI and GI scores, the CPI score is the better predictor.

Key Words: Decayed, filled teeth, missing, periodontal index, quality of life, xerostomia

INTRODUCTION

Oral health has a significant role in general health, by WHO definition including the oral cavity and the relevant tissues health, and the absence of gingival bleeding, xerostomia, lost teeth, periodontal diseases, and disorders that affect the mouth and oral and teeth.[1]

Oral diseases can cause many problems such as eating and speaking disorders, making dissatisfied and disturbed physical health, and interfering with social and daily activities. Oral health could affect facial appearance, masticatory problems, social relationships, emotional health, concentration on

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learning, job absenteeism, and control of diseases in particular.[2-4]

In the last two decades, the oral health-related quality of life (OHRQoL) has attracted special attention in the fields of dentistry and psychology, it has been considered a critical factor in the quality of life. Measuring OHRQoL and its related concepts were developed based on WHO quality of life definition.[5] Therefore, OHRQoL as an outcome could lead to widespread changes in attitude toward treatment's goals.[6] Several measurement tools were developed to cover various aspects of OHRQoL. Oral Health Impact Profile (OHIP-14) is a well-known tool which has 14 questions in seven domains: Functional limitation, physical pain, psychological discomfort, physical disability; psychological disability, social disability.[7]

Oral health has an important contribution to the quality of life. The impact of various oral health statuses on OHRQoL was studied very frequently by researchers and recently in a systematic review 28 of the 37 studies showed a significant relationship between OHRQoL and periodontal diseases by OHIP-14.[8] Buset *et al.* showed that periodontal condition, measured by Community Periodontal Index (CPI) index related, affected OHRQoL level of elderly.[9]

Dental caries and tooth loss is important determinant of OHRQoL. Gerritsen *et al*. by systematic review showed that tooth loss has a strong effect on OHRQoL.[10] Haag *et al.* measure the effect of the total decayed, missing, filled teeth (DMFT) index on OHRQoL. Their study showed that the DMFT index negatively affects the OHRQoL.[8]

Recently, some studies showed that xerostomia has a negative effect on OHRQoL. Locker studied the effect of xerostomia on OHRQoL of the elderly institutionalized population and showed that xerostomia has a significant effect on OHRQoL of them.[11] Thomson measured this relationship among young people and achieved a similar result.[12]

Various oral health aspects affect the OHRQoL in different ways. Masood and their colleagues showed that wearing denture, dental pain, and caries are associated with OHRQoL along with demographic factors in elderly people.[13] Ulinski *et al*. showed that the clinical and sociodemographic factors affect the OHRQoL in the elderly[14]

Although, many studies investigated the relationship of OHRQoL and oral health indicators. So far, we cannot find a study which examine the association of various oral health indexes and oral health-related quality along with demographic variables. Therefore, the purpose of this study is to evaluate the association of oral health indices (various clinical and demographic factors) and the OHRQoL, using the OHIP-14.

MATERIALS AND METHODS

This cross-sectional study was a part of the second phase of the Kerman coronary artery disease risk factors cohort (conducted from September 2014 to April 2018). Totally, 6000 subjects were selected from four predefined urban and preurban areas of the city using the cluster-randomized sampling technique. More technical details about the sampling method and frame can be found in Najafipour *et al*. study[15] The people with age between 18 and 64 years old were entered into the study (Eligibility criteria). Finally, 5657 (2662 male) individuals participated.

The dependent variable of this study is defined based on the OHRQoL of participants. All the participants were asked about their OHRQoL by the OHIP-14 questionnaire after explaining the goal of the study and getting the subjects' consent. Persian version of the questionnaire was previously validated in Iran.[16] Cronbach's alpha coefficient was 0.85, and the ICC coefficient was also calculated at 0.88 in the re-evaluation of the test (95% confidence interval: 0.80-0.93).[16] The answers were scored on a 5-point Likert scale: 0= never; 1= hardly ever; 2= occasionally; 3= fairly often; 4= very often/every day. The OHIP-14 scores can range from 0 to 56. Higher OHIP-14 scores indicate poor OHRQoL. The OHIP-14 scores were calculated by summing the items and dichotomized using median splits. One of the advantages of this method is the easier interpretation of the effect of independent variables on the dependent variable and it has been used by many studies.[17-20] The scores above the median were deemed as having poorer OHIP. An indicator variable for poorer OHIP is defined as the dependent variable.

Additional questions were asked to collect demographic data such as gender, age, marital status, educational status, and employment status. The employment status of the participants was divided

into three categories: Employed, unemployed, and economically inactive. The last category covered anyone who did not seek any jobs, including students, retired, disabled people, etc.

A checklist was used by the researcher that was completed by a single well-trained dentist after the oral examination under the dental unit light and on the dental chair. In the checklist, the total number of decayed, missing (due to caries only), and restored teeth were recorded. These records were used to calculate the DMFT index. Periodontal health status was measured by the CPI index and scored in terms of healthy, bleeding on probing, supra- or sub-gingival calculus pockets 4–5 mm in depth, and pockets >6 mm in depth.[21] Gingival conditions of the participants were measured by the standard inflammation index of the gingival index (GI) and categorized as mild, moderate, and severe inflammation.[22] To assess xerostomia Fox questionnaire was used which is a well-known subjective tool.[23] People with at least one positive answer to the questions were considered as having xerostomia.

At the end, gender, age, marital status, educational status, and employment status, DMFT, CPI, GI and having xerostomia are considered as independent variables. The relationships between the independent variables and dependent variable were examined by *t*-test, Chi-square and multivariable logistic regression, and the best predictors OHIP indices was assessed by a backward elimination procedure.

Ethical considerations

This study was conducted as a research project. The protocol of the study was approved by the Ethical Review Board of Kerman University of Medical Sciences under the code (Permission No. 93/310KA). The research process and its objectives were explained to the participants then the informed consent was signed by the subject or the subject's parents/legally authorized representative before the beginning of the project. The questionnaires were anonymous, and the subjects were reassured about the confidentiality of data.

Data analysis

The data were transferred to SPSS 20. (SPSS Inc., Chicago, Illinois) for statistical analysis. Multiple logistic regression was used to study the variables that could predict the OHIP score. The goodness of fit of the models is examined by Akaike information criterion (AIC) index. The level of significance was set at $P < 0.05$.

RESULTS

In this cross-sectional study, 5657 participants were evaluated. The mean scores for OHRQoL, DMFT, CPI, and GI were, respectively, 24.07 (7.76), 10.7 (6.86), 0.76 (0.96), and 0.63 (0.8). Minimum score of OHIP was 24.07, minimum score was 16, and maximum score was 66. The mean score of OHIP was 23.5 in males and 24.42 in females ($P < 0.001$). Tables 1 and 2 presents descriptive statistics of variables. Of all participants, 60.42% were female and 39.58% were male. The mean age of participants was 38.1 years). Most of the participants were married, and nearly 50% were high school graduates or had a higher education level; 67% of the participants were unemployed. The mean of DMFT, CPI, and GI score was higher in men ($P < 0.001$) and xerostomia was more frequent in women ($P < 0.001$).

Univariate analysis

Table 3 presents the results of the univariate analysis regarding the relationship between poor OHIP and demographic and socioeconomic variables. The results showed that the chance of having a poor OHRQoL in women was 1.27 times higher

Table 1: Descriptive statistics of oral health impact profile by demographic variables

Variables	Frequency (%)	OHIP level	
		Not poor (%)	Poor (%)
Gender			
Male	2239 (39.58)	738 (16.9)	1006 (23.0)
Female	3418 (60.42)	1287 (29.4)	1348 (30.8)
Age			
15-24	494 (8.95)	159 (3.6)	335 (7.7)
25-34	1072 (19.43)	516 (11.8)	555 (12.7)
35-44	1207 (21.87)	613 (14.0)	594 (13.6)
45-54	1132 (20.51)	0	0
55-64	1106 (20.04)	514 (11.7)	587 (13.4)
65-74	507 (9.19)	223 (5.1)	283 (6.5)
Marital status			
Single	695 (12.29)	262 (6.0)	410 (9.4)
Married	4587 (81.09)	1618 (36.9)	1808 (41.3)
Divorced	69 (1.22)	25 (0.6)	22 (0.5)
Widowed	306 (5.41)	120 (2.7)	114 (2.6)
Education			
Illiterate	518 (9.16)	188 (4.3)	205 (4.7)
Primary school or less	1125 (19.89)	367 (8.4)	421 (9.6)
Middle and high	1077 (19.04)	344 (7.9)	423 (9.7)
Diploma and above	2937 (51.92)	1126 (25.7)	1305 (29.8)
Employment status			
Employed	1784 (31.55)	608 (13.9)	757 (17.3)
Unemployed	3802 (67.23)	1388 (31.7)	1565 (35.7)
Economically inactive	69 (1.22)	29 (0.7)	31 (0.7)

OHIP: Oral health impact profile

Table 2: Descriptive statistics decayed, missing, filled teeth, xerostomia, gingival index score, community periodontal index score

Variables	DMFT (SE)	Xerostomia (percent)	GI score (SE)	CPI score (SE)
Sex				
Male	10.87 (0.18)	804 (35.91)	0.6 (0.02)	0.77 (0.95)
Female	10.6 (0.12)	1314 (38.45)	0.65 (0.02)	0.45 (0.62)
Age				
15-24	4.17 (0.16)	170 (34.41)	0.27 (0.03)	0.54 (0.82)
25-34	8.07 (0.15)	366 (34.14)	0.46 (0.02)	0.75 (0.93)
35-44	10.45 (0.18)	413 (34.22)	0.62 (0.02)	0.98 (1.03)
45-54	13.04 (0.22)	422 (37.31)	0.77 (0.03)	1.05 (1.06)
55-64	14.7 (0.27)	459 (41.5)	0.86 (0.03)	1.18 (1.1)
65-74	16.67 (0.52)	223 (43.98)	1 (0.06)	0.42 (0.75)
Marital status				
Single	5.65 (0.19)	229 (33)	0.35 (0.02)	0.81 (0.98)
Married	11.48 (0.11)	1709 (37.26)	0.67 (0.01)	0.89 (1.02)
Divorced	11 (0.77)	30 (43.48)	0.77 (0.11)	1.11 (1.04)
Widowed	14.96 (0.57)	150 (49.02)	0.96 (0.07)	1.3 (1.09)
Education				
Illiterate	17.24 (0.49)	269 (51.93)	1.11 (0.06)	1.13 (1.05)
Primary school or less	13.98 (0.27)	482 (42.84)	0.97 (0.03)	0.79 (0.96)
Middle and high	10.82 (0.24)	401 (37.27)	0.66 (0.03)	0.61 (0.89)
Diploma and above	9.24 (0.12)	966 (32.89)	0.49 (0.01)	0.8 (0.97)
Employment status				
Employed	10.47 (0.17)	602 (33.74)	0.54 (0.02)	0.77 (0.97)
Unemployed	10.9 (0.13)	1486 (39.09)	0.68 (0.02)	0.69 (0.94)
Economically inactive	7.51 (0.8)	29 (42.03)	0.38 (0.08)	0.77 (0.95)

DMFT: Decayed, missing, filled teeth; GI: Gingival index; CPI: Community periodontal index; SE: Standard error

than that in men ($P < 0.001$). Furthermore, an association was found between age and poor quality of life (OHIP) ($P < 0.001$). Finally, the chance of having a poor OHIP was higher in married, divorced, and widowed participants compared to single subjects ($P < 0.001$) by 1.38, 2.13, and 1.62 times, respectively.

The relationship between OHIP and oral health indexes is present in Table 3. The chance of having a poor quality of life in subjects with xerostomia was 2.03 times higher than that in those without xerostomia ($P < 0.001$), and the chance of having a poor quality of life in people with mild and severe gingivitis were 1.93 and 4.30, respectively, compared to those with healthy gingiva ($P < 0.001$, $P < 0.001$). The chance of poorer quality of life was 1.205 and 1.120 times higher in participants with supra- or subgingival calculus and pocket with 4–5 mm depth compare to healthy CPI index.

Finally, analysis of the relationship between DMFT and poor oral health showed that the chance of poor quality of life increased by 1.08 times per unit increase in DMFT ($P < 0.001$). This means a person with a DMFT of 20 should have a 4.7 higher chance of poor OHRQoL compared to those with DMFT of zero.

Multivariate analysis

To find the most important variables affecting the chance of having poor OHIP, a multivariate analysis was run by multiple logistic regression, and a backward elimination procedure was used to find the best subset of variables. The results of the backward elimination procedure are shown in Table 4.

The final model showed that gender, age, and education remained as effective variables among demographic and socioeconomic variables; xerostomia, CPI index, and DMFT index remained as effective variables among oral health status variables.

The results of the final model in Table 4 shows that females had a higher chance of poor OHIP compared to males ($P < 0.001$), and the chance of poorer OHIP decreased in the 55–64 and 65–74 age groups ($P = 0.002$, $P = 0.003$) the role of age changed to be a protective factor, surprisingly.

For participants with a high CPI index, the chance of poor OHIP was 2.105 times higher than that in subjects with a normal CPI index. Furthermore in participants with xerostomia, the chance of poor OHIP increased by 1.7 ($P < 0.001$), and the chance of poor OHIP increased by 1.2 times per unit increase in DMFT index ($P < 0.001$).

DISCUSSION

Our results showed that the decayed, missed, and filled teeth and bad periodontal conditions of people have negative effect on their OHRQoL. Furthermore, the participants with xerostomia had lower OHRQoL than others. The aged people did not have poorer OHRQoL than the younger people and women had poorer OHRQoL than men. The education level of people negatively affected the OHRQoL of them.

In this study, we measured the impact of demographic variables (gender and age) on OHIP and their controlling effect on oral health indices. The data showed that women were 1.27 times more probable to have a poorer OHRQoL compared to men. The results are supported by different studies with large

Table 3: Univariate analysis of relation between oral health impact profile level and independent variables

Variables	Levels	OR (crude)	95% CI	Significance
Gender	Male (reference)	1		
	Female	1.27	1.141-1.415	<0.001
Age	15-24 (reference)	1		
	25-34	1.380	1.321-1.441	<0.001
	35-44	1.126	1.059-1.198	<0.001
	45-54	1.156	1.097-1.219	<0.001
	55-64	1.180	1.119-1.243	<0.001
	65-74	1.204	1.143-1.269	<0.001
Marital status	Single (reference)	1		
	Married	1.389	1.179-1.633	<0.001
	Divorced	2.132	1.290-3.521	0.003
	Widowed	1.629	1.242-2.135	<0.001
Education	Illiterate (reference)	1		
	Primary school or less	0.977	0.928-1.029	0.388
	Middle and high	0.972	0.922-1.024	0.279
	Diploma and above	0.974	0.93-1.021	0.275
Employment status	Employed (reference)	1		
	Unemployed	1.017	0.989-1.046	0.238
	Economically inactive	1.038	0.921-1.171	0.539
Xerostomia	Have not	1		
	Have	2.035	1.824-2.27	<0.001
GI	Healthy	1		
	Mild inflammation	1.061	0.921-1.221	0.408
	Moderate inflammation	1.939	1.673-2.245	<0.001
	Severe inflammation	4.306	2.020-9.175	<0.001
CPI	Healthy	1		
	Bleeding on probing	1.045	0.998-1.095	0.063
	Supra-or subgingival calculus	1.205	1.166-1.246	<0.001
	Pocket with 4-5 mm depth	1.120	1.033-1.215	0.006
DMFT	Per unit	1.081	1.07-1.091	<0.001

DMFT: Decayed, missing, filled teeth; GI: Gingival index; CPI: Community periodontal index; OR: Odds ratio; CI: Confidence interval

Table 4: Odds ratios of final model of backward multivariabe logistic regression

Variables	Levels	OR (adjusted)	95% CI	Significance
Gender	Male (reference)	1		
	Female	1.276	1.111-1.467	0.001
Age	15-24 (reference)	1		
	25-34	1.288	0.996-1.665	0.054
	35-44	1.090	0.838-1.417	0.519
	45-54	0.800	0.603-1.061	0.123
	55-64	0.617	0.450-0.846	0.003
	65-74	0.511	0.331-0.788	0.002
Education	Illiterate (reference)	1		
	Primary school or less	1.160	0.804-1.673	0.427
	Middle and high	1.203	0.826-1.753	0.334
	Diploma and above	1.658	1.159-2.374	0.006
Xerostomia	Have not	1		
	Have	1.704	1.480-1.962	<0.001
CPI	Healthy	1		
	Bleeding on probing	0.973	0.792-1.196	0.375
	Supra-or subgingival calculus	2.105	1.810-2.447	<0.001
	Pocket with 4-5 mm depth	1.194	0.816-1.746	<0.001
DMFT	Per unit	1.205	1.158-1.269	<0.001

DMFT: Decayed, missing, filled teeth; GI: Gingival index; CPI: Community periodontal index; OR: Odds ratio; CI: Confidence interval

sample sizes.[24,25] Furthermore, Cohen-Carneiro *et al*., in their review article, reported a low level of OHRQoL in women.[26] Some studies with moderate and small sample sizes have not shown this relationship.[27,28] Steele *et al.*[29] and Batra *et al.* reported that the OHIP-14 scores of females were higher in the United Kingdom and Australia, which is different from the results of the present study In addition, the evidence relates women's poorer quality of life to dental anxiety.[30] Therefore, it seems reasonable to expect a relationship between OHRQoL and gender.

Analysis of OHIP in age categories showed that older people had not poorer OHIP. But people experience caries and tooth loss with aging, which is aggravated by developing systemic diseases, and consequently, periodontal diseases in older people.[31,32] However, it has been shown that tooth loss as a factor of DMFT and age affect the OHRQoL independently. Therefore, we should expect that OHRQoL depends on age. However, in a study by Collins *et al*.,[33] there was no significant relationship between age, and OHRQoL, which might be attributed to the effect of oral health status on the quality of life, especially in adolescents, resulting in satisfaction with the appearance or a feeling of shame in social contacts. The relationship between poor OHIP and age may be related to lower levels of education in the elderly.

In the present study, the dental status of the participants was measured in terms of the DMFT index, and the analysis of the index showed that the participants with a higher DMFT had a poorer OHIP. The study showed that with each unit increase in DMFT, the quality of life associated with oral health was 1.2 times lower. Some studies suggest that DMFT might not be a predictor of the quality of life. Since dental caries is only detected by observation, only visible caries and missing teeth are recorded. In the present study, the dental status of the participants was measured by the DMFT index, and the analysis of the index showed that participants with a higher DMFT had a poorer OHIP, consistent with many previous studies.[34-36] Decayed and missing teeth directly affect functional limitations and physical discomfort. Therefore, an inverse relationship between the DMFT index and OHIP score is reasonable.

In this study, the participants with xerostomia had 1.704 times higher chance of poorer OHIP compared to those without xerostomia. Xerostomia is a subjective cause, and because of different methods of measuring xerostomia, it is difficult to compare the results of different studies. Thomson showed that chronic dry mouth (xerostomia) is directly associated with poorer OHRQoL in middle-aged participants.[37] Previous studies have shown that age is a factor affecting the development of xerostomia;[38-40] in a study by Locker, aging resulted in a decrease in OHRQoL. Several studies have shown a relationship between xerostomia and OHIP. Niklander *et al*. showed that participants with xerostomia had higher OHIP scores or poorer quality of life.[41]

The results of the present study showed that subjects with higher CPI were 2.105 times less likely to have poor OHIP than those without periodontal disease. Previous studies have shown that severe periodontitis can result in significantly poorer OHIP.[42] However, attachment loss in patients with severe periodontitis can impair dental aesthetics and function; therefore, it is an effective factor in OHIP. However, patients with mild-to-moderate periodontitis do not know much about the symptoms of their primary symptoms. The presence or severity of periodontal diseases can be related to other variables, such as age and underlying disorders such as diabetes, drugs, special treatments, or infectious diseases such as AIDS.[43]

Moreover, the present study showed that higher education level increases OHIP scores. Hassel *et al*. showed that the educational level significantly affected OHIP[44] and Cohen-Carneiro showed this similarity in a systematic review of 323 articles with subjective indicators of the impact on the OHRQoL.[45]

In the present study, the dental status of participants measured by DMFT index and analyzing the index showed participants with the higher DMFT have the poorer OHIP. This result repeated by many studies.[34,46,47] OHIP-14 questioner was designed to measure functional limitation, physical discomfort, psychological discomfort, physical disability, psychological disability, social disability, and handicaps. Furthermore, decayed and missing teeth affect functional limitation physical discomfort, directly. Therefore, inverse relation between the DMFT index and OHIP is reasonable.

The sample size is a very important condition for inferring to a larger population, however, the sample size calculation must be estimated according to a specific hypothesis. The strength of the study was the

large sample size, which ensured the power of the study. Therefore, statistical tests could detect even weak relationships and the value of odds ratios are more meaningful. A limitation of the present study was that women had a higher response rate, which might be related to the fact that women pay more attention to their health. Another limitation was the effect of some factors such as population heterogeneity of culture, health habits, psychological factors, and economic factors remain unknown. Another limitation of the study was the subject measurement of xerostomia. Answering xerostomia questioner for elder people and lower educational levels make some difficulty in measurements. Therefore, it is suggested that psychological factors and oral health behavior and economic factors are considered for future studies.

CONCLUSION

By comparing the range of variables and their coefficient, it can be concluded that DMFT, xerostomia, and CPI scores are strongly related to OHIP scores, respectively. Furthermore, of CPI and GI score, the CPI score has more predictive power. Therefore, in future studies, it could be advisable to use the CPI score for periodontal status. Therefore, it is necessary to pay more attention to effective and relevant factors when planning oral health interventions.

Informed consent

The authors have obtained the informed consent of the subject or the subject's parents/legally authorized representative.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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