



The relationship between oral health literacy and dental caries experienced among pregnant women in Arak, Iran, in 2021

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Abstract

Background: Health literacy is recognized as a key determinant of health-related behaviors and outcomes. This study aimed to investigate the relationship between oral health literacy (OHL) and dental caries experience among pregnant women.

Methods: This descriptive-analytical study was conducted on 275 pregnant women in Arak, Iran. Demographic information, self-reported oral health, and brushing frequencies were collected using a questionnaire. The Oral Health Literacy Adults Questionnaire (OHL-AQ) was used to measure the level of health literacy. Dental caries experience was assessed using the DMFT index (decayed, missing, filled teeth).

Results: The age of pregnant women participating in the study averaged 29.67 ± 5.54 years. The average OHL score was 10.14 out of 17. Adequate OHL was observed in only 38.5% of pregnant women. The participants' DMFT score averaged 9.39 ± 4.43 . A significantly lower mean score for decayed teeth ($P=0.001$) and a higher mean score for filled teeth ($P=0.013$) were recorded in a higher percentage of participants with adequate OHL than those with marginal and inadequate OHL. By adjusting the effect of potential confounding factors, the results of the multiple linear regression model revealed no significant relationships between OHL and DMFT among pregnant women participating in the study ($P=0.934$).

Conclusion: Fewer decayed teeth and more filled teeth were observed in pregnant women with higher OHL. The promotion of OHL may lead to adherence to health behaviors and subsequently health outcomes for the individual.

Keywords: Pregnancy, Oral health, Health literacy, DMF index

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Introduction

Studies have shown that health literacy is a key determinant of health-related behaviors and outcomes.¹ Limited health literacy is associated with reduced knowledge about diseases, self-care skills, medication adherence, and use of health services and increased risk of mortality and costs related to services. People with higher health literacy generally have better health than those with low health literacy.^{2,3} The WHO Commission on Social Determinants of Health (CSDH) has assigned a central role to health literacy in determining health inequalities in both rich and poor countries.⁴ According to the announcement by the American Medical Association, poor health literacy is a stronger predictor than age, income, economic status,

literacy level, and race.⁴ Oral health literacy (OHL) is a subset of health literacy and is defined as “the degree to which individuals have the capacity to obtain, assess, and understand basic oral health information and services needed to make appropriate oral health decisions”.⁵

Additionally, oral health has been shown to be related to the general health of a pregnant woman during pregnancy and is of particular importance due to local and systemic effects on her body.^{6–9} Pregnant women are more vulnerable to periodontal diseases and dental caries during pregnancy due to physiological conditions, hormonal changes, and nutritional conditions.¹⁰ Also, poor oral health of the mother increases the risk of early childhood caries.¹¹ Studies have shown that OHL



is generally not ideal in Iran. Studies by Naghibi Sistani et al¹² among 1031 participants in Tehran, Fazli et al¹³ among 828 couples in a premarital counseling center in Zanjan, and Malek Mohammadi et al¹⁴ among 264 adults in Kerman indicated that adequate OHL was found in 40.5%, 21%, and 62.5%, respectively. The study by Karimi Afshar and colleagues in Kerman also showed that 59.4% of the participants had insufficient OHL among pregnant women.¹⁵ A systematic review in this field suggests that limited studies have investigated the relationship between the dental caries experience and OHL.¹⁶ Moreover, it seems necessary to conduct a study in socioeconomically different communities to investigate the relationship between OHL and clinical oral health outcomes. The present study, therefore, aims to investigate the relationship between OHL and the dental caries experience in pregnant women.

Methods

The current cross-sectional and descriptive-analytical study was conducted on 275 pregnant women covered by the health centers in the city of Arak (in central Iran) between July and September of 2021. The following formula was used to determine the sample size: $N = pq(z1 - \alpha / 2) 2 / (d)2$

Considering $\alpha = 0.05$ and $p = 40.5$ which indicates the adequate health literacy based on a previous study,¹² and $d = 0.052$, and applying a cluster sampling correction coefficient of 1.5 times, the final sample size of 275 people was determined. A total number of 2047 pregnant women with records on the integrated health system (<https://sib.iums.ac.ir>) were available in the health centers of Arak at the beginning of the sampling phase. Therefore, this number of samples seems to represent the studied population. The samples were chosen by the random cluster sampling method. Since the city of Arak has five municipal districts, the health centers were chosen

from all five districts. Some of the health centers were randomly selected from each of the districts according to their scope and population. The total number of pregnant women in each health center was determined using the SIB website. Then, pregnant women were selected using a simple random method based on the sample size assigned to each center (Figure 1). A pregnant woman was included in the study if she agreed to participate. Informed consent was completed by all participants. Inclusion criteria were having a pregnancy record in one of the health centers of Arak city and the ability to read and write in Farsi. Exclusion criteria were undergoing orthodontic treatment, complicated problems during pregnancy, and non-completion or incomplete filling of the questionnaire.

The data collection tool consisted of three sections. The first section included questions related to demographic variables (insurance status, education level, number of children, occupation, housing status, and age), self-reported oral health, and brushing frequencies. The second part comprised a DMFT (decayed, missing, filled teeth) checklist, and the third part consisted of the OHL questions using the Oral Health Literacy Adults Questionnaire (OHL-AQ). The validity and reliability of the OHL-AQ have previously been confirmed in Iranian and non-Iranian societies.¹⁷⁻²⁰ Self-reported oral health was classified into poor, moderate, and good levels. Brushing frequencies were divided into two groups of less than and more than 2 times a day. The levels of education, occupation, and housing status were measured to determine the socioeconomic status of the participants.

The OHL-AQ consists of 17 questions in four parts, viz. comprehension (six questions), working with numbers (four questions), listening (two questions), and decision making (five questions). The questionnaire is completed through self-reporting by the participant and a short interview with a trained interviewer. The listening part is

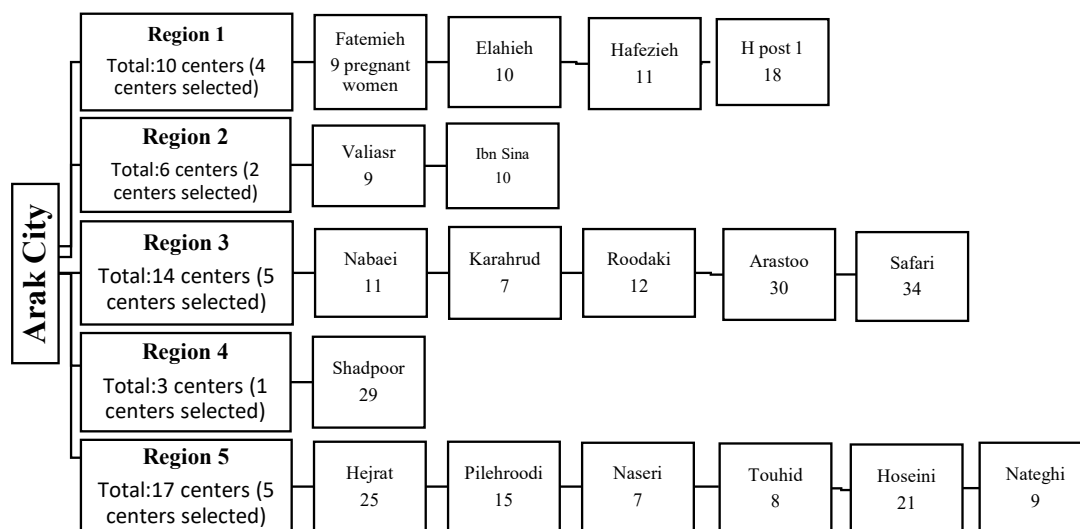


Figure 1. Strategy of sampling

performed by an interviewer, who reads three sentences about care after tooth extraction loudly twice. The interviewee listens and then writes the answers to the questions in this part. One and zero points are given to each correct and incorrect answer, respectively. Correct answers are summed for a total score from 0 to 17. For the data analysis, OHL was divided into three categories: inadequate (0–9 points), marginal (10–11 points), and adequate (12–17 points) health literacy.

All examinations were performed by an oral hygienist using a dental mirror and a dental explorer while the woman was sitting in a chair in a separate room at the health center. To determine DMFT, examinations were based on WHO recommendations.²¹

The oral hygienist was calibrated by the dental clinic of Arak health center at Arak University of Medical Sciences.

The oral hygienist had 2 years of experience working in the dental clinic of the health center and had performed preventive treatments such as dental scaling and brosaage for pregnant women. The Kappa agreement between the examiner and dental clinic were 0.91.

Data were analyzed by SPSS 18 software using descriptive statistics (frequency, percentage, mean, and standard deviation) to describe the data. Frequencies and means were compared by the chi-square test and one-way analysis of variance (ANOVA). The effect of the OHL level on DMFT was determined using multiple linear regression analysis by adjusting confounders. A significance level of $P < 0.05$ was considered for relationships.

Results

The age of pregnant women participating in the study averaged 29.67 ± 5.54 years (range 18–46 years) with an average gestational age of 24.77 ± 9.05 weeks. Housewives comprised 242 (88%) participants, and 106 (38.5%) women had academic education. Among the participants, 124 (45.09%) individuals had no children, and 33.09% were house owners. Only 26.2% of the participants rated their oral health as good, and only 66 (24%) of the participants brushed twice a day. Table 1 shows the distribution of health literacy levels based on demographic characteristics, self-reported oral health, brushing frequencies, and the scores of DMFT. A comparison of health literacy levels in different groups in terms of demographic characteristics indicated significant differences in terms of OHL levels between different educational, occupational, and groups with or without insurance. As such, adequate OHL was observed in a higher percentage of employed pregnant women with academic education and insurance than in the other groups. Moreover, the women were significantly different in terms of brushing frequencies and the evaluation of oral health status in terms of OHL levels. Thus, adequate OHL was recorded in a higher percentage of women who

brushed twice or more a day, and their oral health was evaluated to be better than the other groups (Table 1).

The average OHL score was 10.14 ± 3.72 out of 17 points. In general, inadequate and marginal OHL levels were noticed in 38.2% and 23.3% of pregnant women, respectively, and only 38.5% of subjects had adequate OHL. Among the participants, the mean and standard deviation of DMFT were 9.39 ± 4.43 , 3.11 ± 3.10 , 2.48 ± 2.76 , and 3.79 ± 3.94 , respectively. Dental caries accounted for 33% of DMFT, and 40% of DMFT belonged to filled teeth. Generally, no significant difference was observed between OHL levels in terms of missing teeth scores and DMFT scores. However, significant differences were detected between the three levels of OHL regarding the scores of decayed teeth and filled teeth. A significantly lower average score for decayed teeth ($P = 0.001$) and a higher average score for filled teeth ($P = 0.013$) were recorded in women with adequate OHL than those with marginal and inadequate OHL levels (Table 1).

Multiple linear regression analysis was used to examine the relationship between DMFT (dependent variable) and OHL, demographic variables, self-reported oral health, and brushing frequency (independent variables). The results of the analysis showed no significant relationship between OHL and DMFT after controlling for the influence of confounding factors. In the adjusted model, significant relationships were detected between the age of pregnant women ($\beta = 0.157$; 95% CI: 0.531, 1.817; $P < 0.001$), the number of children ($\beta = 0.127$; 95% CI: 0.201, 1.245; $P = 0.007$), job ($\beta = -0.105$; 95% CI: -2.444, -0.245; $P = 0.017$), insurance status ($\beta = -0.131$; 95% CI: -2.651, -0.611; $P = 0.002$), and self-reported oral health ($\beta = -0.293$; 95% CI: -2.421, -1.355; $P = 0.001$) with DMFT (Table 2). The larger the value of t , the weaker the assumption of the coefficient being zero, and therefore the role of that variable in the modeling increases. Therefore, according to the values of t , the self-reported oral health variable has the largest role among the variables.

Discussion

The aim of the present study was to investigate the relationship between OHL and DMFT in pregnant women. The results demonstrated that the average OHL score was 10.14 points out of 17, and adequate OHL was observed in only 38.5% of individuals. Average OHL scores of 10.5, 12.7, and 7.86 were reported in the studies of Naghibi Sistani et al¹² in Tehran, Malek Mohammadi et al¹⁴ in Kerman, and Fazli et al,¹³ respectively, using the OHL-AQ. The observed difference can be attributed to the measurement of OHL in various target groups with different socioeconomic and cultural backgrounds.

According to our results, the mean and standard deviation of DMFT was 9.39 ± 4.43 , compared to 10.34 ± 5.10 , obtained by Dehghanipour et al among 407 pregnant women in Varamin, Iran.²² A national

Table 1. Distribution of study variables based on oral health literacy levels

Independent variables	Category	No. (%)	inadequate OHL	Marginal OHL	Adequate OHL	P values
			(0–9 Points) No. (%)	(10–11 points) No. (%)	(12–17 points) No. (%)	
Age	Under 25 years	63 (22.9)	26 (41.26)	18 (28.56)	19 (30.15)	0.356*
	26 to 35 years	168 (61.1)	59 (35.11)	37 (22.02)	72 (42.85)	
	More than 36 years	44 (16)	20 (45.45)	9 (20.45)	15 (34.09)	
Level of education	Under high-school diploma	53 (19.2)	42 (79.24)	7 (13.20)	4 (7.54)	<0.001*
	High school diploma	116 (42.5)	45 (38.79)	31 (26.72)	40 (34.48)	
	University	106 (38.5)	18 (16.98)	26 (24.52)	62 (58.49)	
Number of children	Without children	124 (45.09)	41 (33.06)	33 (26.61)	50 (40.32)	0.109*
	One child	98 (35.6)	36 (36.73)	20 (20.40)	42 (42.85)	
	Two or more children	53 (19.2)	28 (52.83)	11 (20.75)	14 (26.41)	
Job	Homemaker	242 (88)	98 (40.49)	57 (23.55)	87 (35.95)	0.040*
	Employed	33 (12)	7 (21.21)	7 (21.21)	19 (57.57)	
Housing status	Tenant	145 (52.7)	56 (38.62)	35 (24.13)	54 (37.24)	0.842*
	Owner	91 (33.09)	32 (35.16)	20 (21.97)	39 (42.85)	
	Living with parents	39 (14.18)	17 (43.58)	9 (23.07)	13 (33.33)	
Insurance status	Yes	233 (84.7)	81(34.76)	58 (24.89)	94 (40.34)	0.022*
	No	42 (15.27)	24(51.14)	6 (14.28)	12 (28.57)	
Self-reported oral health	Poor	58 (21.1)	26 (44.82)	17 (29.31)	15 (25.86)	0.014*
	Moderate	145 (52.7)	62 (42.75)	28 (19.31)	55 (37.93)	
	Good	72 (26.2)	17 (23.61)	19 (26.38)	36 (50)	
Brushing Frequency	Less than twice a day	209 (76)	87 (41.62)	45 (21.53)	77 (36.84)	<0.001*
	Twice or more a day	66 (24)	18 (27.27)	19 (28.78)	29 (43.93)	
Caries Experience	Decayed Teeth	3.11±3.10	3.60±3.22	3.79±3.51	2.21±2.48	0.001**
	Missing Teeth	2.48±2.76	2.95±3.30	2.20±2.35	2.19±2.34	0.091**
	Filled Teeth	3.79±3.94	3.19±4.15	3.32±3.75	4.67±3.72	0.013**
	DMFT	9.39±4.43	9.74±4.99	9.32±4.11	9.09±4.01	0.564**

OHL: Oral health literacy, DMFT indicates the number of decayed, missing, and filled permanent teeth.
*Chi-square test; ** One-way ANOVA.

Table 2. Association between oral health literacy and DMFT using multiple linear regression

Independent variables	Unstandardized Coefficients		Standardized Coefficients	t	P value	95% CI for regression coefficients (B)	
	B	Standard error	Beta			Lower bound	Upper bound
	Constant number	12.246	1.273				9.623
Age	1.174	0.327	0.157	3.589	0.000	0.531	1.817
Level of Education	-0.252	0.305	-0.042	-0.827	0.409	-0.852	0.347
Number of children	0.723	0.266	0.127	2.720	0.007	0.201	1.245
Job	-1.344	0.560	-0.105	-2.402	0.017	-2.444	-0.245
Housing status	0.079	0.263	0.013	0.300	0.764	-0.437	0.595
Insurance status	-1.631	0.519	-0.131	-3.142	0.002	-2.651	-0.611
Self-reported oral health	-1.888	0.271	-0.293	-6.959	0.000	-2.421	-1.355
Brushing frequency	0.048	0.437	0.005	0.109	0.914	-0.812	0.907
Oral Health Literacy	0.012	0.056	0.010	0.211	0.833	-0.099	0.123

survey of oral health status in the healthcare system of Iran indicated that the DMFT index was 13.07 in Iranian women aged 35–44 years.²³ In the present study, the lower index than the national average can be because our study

was conducted among women with an average age of 29 years in an urban community.

The results of the present study showed a significantly lower average score for decayed teeth and a higher

average score for filled teeth in people with adequate OHL than those with marginal and inadequate OHL. In studies conducted by Baskaradoss²⁴ and Blizniuk et al,²⁵ individuals with limited OHL obtained a significantly higher average number of missing teeth and a lower average number of filled teeth than those with adequate OHL. Ueno et al²⁶ also found fewer decayed teeth in people with higher OHL. To explain this issue, it can be stated that people with higher OHL may have more knowledge about oral and dental health and will probably better adhere to preventive measures related to oral health such as brushing, flossing, and visiting a dentist regularly for timely treatment.

As indicated by our results, no significant relationship was found between health literacy and DMFT after controlling for confounding factors. However, Baskaradoss²⁴ observed no significant correlation between the DMFT index and OHL. On the other hand, Fazli et al¹³ found a significant relationship between adequate OHL with a lower number of decayed teeth and missing teeth, but they observed no relationship between filled teeth and OHL. Haridas et al²⁷ detected no correlation between decayed teeth and OHL, but a significant correlation was observed between low OHL levels and a higher DMFT index. No correlation was found between decayed teeth and OHL in the study of Blizniuk et al²⁵ whereas Ueno et al²⁶ reported a significant relationship between higher OHL and fewer decayed teeth. The observed discrepancies in the results of the studies may result from different target groups in terms of socioeconomic culture, sampling, second-hand information, inconsideration of confounding factors in data analysis, using a different framework for OHL measurement, and other methodological issues.¹⁶ The relationships between OHL and preventive behaviors related to oral health, such as brushing teeth, visiting a dentist, etc, have been shown in various studies.^{13,14,26} Thus, the failure to detect a relationship between OHL and clinical oral health outcomes in some studies may support the concept that OHL is not a direct influencing factor but a mediator between socioeconomic factors, health behaviors, and oral health outcomes.^{2,16}

The present study showed significant differences between various groups of education, occupation, and insurance coverage/non-coverage in terms of OHL levels. As such, adequate OHL was observed in a higher percentage of employed pregnant women with academic education, and insurance coverage than the other groups. Similar results were previously reported in other studies,^{14,15,24,28} which can be related to a complex network of socioeconomic determinants. Moreover, OHL levels were significantly different between various women in terms of their brushing frequency and self-reported oral health, which is in line with other studies.^{14,15,26,29} Adequate OHL was found in a higher percentage of

those who evaluated their oral health status to be good than those who reported their oral health status to be moderate or poor. The present results also disclosed significant associations between DMFT and age, number of children, job, insurance status, and self-reported oral health. These results are consistent with the results of other studies,^{13,28,30} but they are not discussed further because these relationships are not included in the objectives of this study.

Strengths and Limitations

One strength of the study is that the information about the level of OHL in pregnant women was provided using a standard questionnaire with measured validity and reliability in previous studies. The determining of DMFT among pregnant women is another strength of this study. Considering that health care centers cover about 85% of all pregnant women in the city, the sample can be representative of the target population.

The present study had some limitations. One of the limitations was that the samples were selected from the urban community and the rural community, with its different socio-cultural background, was not covered in the sampling. Another limitation of the present study is the descriptive study design, which hinders the cause and effect explanation of the relationships between the variables. It is recommended that studies be designed to investigate cause and effect relationships. It is also recommended that similar studies be conducted in other settings (private clinics, offices, etc) to examine more clinical indicators.

Conclusion

According to the results, fewer decayed teeth and more filled teeth were observed in pregnant women with higher OHL. The promotion of OHL in pregnant women may lead to their adherence to health behaviors and subsequent health outcomes. However, more studies are needed to investigate this relationship in different target groups and contexts.

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Authors' Contribution

Conceptualization: Saeid Bashirian, Majid Barati.

Data curation: Maryam Barati.

Formal analysis: Salman Khazaei, Maryam Barati.

Investigation: Maryam Barati.

Methodology: Majid Barati.

Project administration: Saeid Bashirian, Maryam Barati.

Resources: Leila Gholami, Maryam Barati.

Software: Salman Khazaei, Maryam Barati.

Supervision: Ensiyeh Jenabi.

Validation: Leila Gholami, Maryam Barati.

Visualization: Saeid Bashirian, Majid Barati.

Writing—original draft: Maryam Barati.

Writing–review & editing: Maryam Barati, Samane Shirahmadi.

Competing Interests

The authors have declared that no conflict of interest exists.

Data Availability Statement

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Ethical Approval

This study was approved by the Research Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1399.863).

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