

Relationship between Periodontal Status and Associated Factors in Pregnant Women in Kashan: A Cross-Sectional Study

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(Submitted: 9 March 2024 – Revised version received: 22 May 2024 – Accepted: 25 May 2024 – Published online: Spring 2024)

Abstract

Objectives: Hormonal changes during pregnancy may act as a modifying factor in the pathogenesis of periodontal disease, which is reported as a potential risk factor for adverse pregnancy outcomes. This study was conducted to investigate the level of periodontal disease in pregnant women and identify the associated risk factors in a population of pregnant women in Kashan, Iran.

Methods: A total of 128 pregnant women in the second and third trimesters of pregnancy were recruited. Demographic data, oral health behaviors, and socioeconomic status (SES) were determined using a standard questionnaire. The periodontal status was evaluated using the Community Periodontal Index (CPI), clinical attachment loss (CAL), and bleeding on probing (BOP).

Results: The mean age of the participants was 24.35 ± 3.4 . More than half of them (53.1%) were in the second trimester of pregnancy. A quarter of pregnant women had visited a dentist within the past year, of which more than 74% visited the dentist for pain or treatment. Approximately half of the participants (50.8%) brushed their teeth daily, but only 10% had a daily flossing habit. Periodontal screening was typically done using the CPI. Calculus had the highest score (49.2%) prevailing among the subjects, while the prevalence of periodontitis (pocket depth ≥ 3) was 35.2%. Pocket depth ≥ 3 mm was less frequent in women with academic education, good SES, those without a history of pain, those who brushed their teeth twice a day or more, and those who visited the dentist ($P < 0.05$).

Conclusion: The findings of the present study showed that poor perceived oral health, a history of toothache, no daily use of toothbrushes and dental floss, low education level, and poor SES were associated with periodontal disease in pregnant women.

Keywords: Oral health; Periodontal index; Health behavior; Economic status; Pregnant women

How to cite:

Ghorbani Z, Ehteram M, Namdari M, Mostafapour P. Relationship between Periodontal Status and Associated Factors in Pregnant Women in Kashan: A Cross-Sectional Study. *J Dent Sch* 2024;42(1):7-13.

Introduction

Periodontal diseases are mainly the result of infections and inflammation of gums and bones that surround and support the teeth.¹ Many studies have shown that periodontal disease during pregnancy is associated with perinatal outcomes, including preeclampsia, preterm childbirth, and low birth weight.

It is well established that increased inflammatory changes in the gums occur mainly during pregnancy. In other words, pregnancy gingivitis does not require the presence of previous gingivitis or accumulation of previous dental plaque.² The prevalence and intensity of gingivitis increases during pregnancy and decreases after childbirth.³ Lower educational level and unemployment are significantly associated with higher gingival index and periodontal pocket depth ($P < 0.01$).⁴ One of the most important and well-known indicators for determining periodontal treatment needs is the Community Periodontal Index (CPI), commissioned by the World Health Organization (WHO) and designed by Ainamo et al. in 1982.⁵ Because of the comprehensive use of this index in epidemiologic studies, researchers used the Community Periodontal Index of Treatment Needs (CPITN) in clinics to determine periodontal treatments in patients, which was considered successful.⁶ Socioeconomic status (SES) affects

oral health and general health. Oral health may be affected by oral hygiene habits and dental services seeking.⁷ In a study, although the plaque level remained unchanged, gingival index increased significantly, with its peak in the third trimester of pregnancy, but decreased in the third month after childbirth.⁸ A significant relationship was reported between CPITN and gestational age, educational level, SES, and frequency of brushing teeth.⁹ Oral health education programs during pregnancy can contribute to the health of the gums and tissues that support the teeth, as well as the health of the baby.¹⁰ An increase in gingivitis, an increase in periodontal disease, and a significant increase in CPITN values may be observed during pregnancy.¹¹ Many studies have shown that periodontal diseases in pregnancy are accompanied by prenatal consequences, such as preeclampsia, preterm childbirth, and low birth weight. Insufficient oral health care during pregnancy can have adverse outcomes for both mothers and their newborns.^{2,13,14} Therefore, pregnant women should receive proper oral hygiene and preventive services before, during, and even after pregnancy.¹⁵ Although many studies have reported clinical oral health indices during pregnancy around the world, few reports exist about them in Iran.

A search in the PubMed database with medical subject headings (MeSH) terms of “pregnant women” and “oral health” in March 2022 resulted in finding 67 papers, of

which only five were conducted in Iran.¹⁶⁻²⁰ This shortage of literature may be due to ignoring oral health as part of needed maternal care and having fewer dental visits during pregnancy.

The present study aimed to investigate the relationship between periodontal status and associated factors in pregnant women in Kashan, Iran. To investigate the relationship of periodontal status with SES and dental behavior factors in pregnant women in Kashan, 128 pregnant women were examined in the second and third trimesters of pregnancy. This information was planned to be used for future interventions regarding oral health promotion among this target population.

Methods

The current descriptive cross-sectional study was conducted from August to September 2017 based on a convenient sampling of pregnant women referred to the Specialized Obstetrics and Gynecology Clinic at Kashan University of Medical Sciences (Naghavi Specialized Medical-Educational Center) by examination and interview techniques. Kashan is a small city in Iran with 364,482 inhabitants according to the 2016 census (<https://www.amar.org.ir/english/Population-and-Housing-Censuses>). This study was approved by the Ethics Committee in Research Affairs, School of Dentistry, Shahid Beheshti University of Medical Sciences (code: IR.SBMU.DRC.REC.1397.003). After explaining research objectives and procedures, written informed consent was obtained from the participants. Participant confidentiality was also maintained throughout the study.

Sample Size and Subject Recruitment

According to a previous study⁹, 19.2% of Iranian women needed periodontal treatment (CPI codes 3 or 4). Considering 95% confidence interval with an error of 0.07, a sample of 122 subjects was needed to participate in the study. The target population consisted of pregnant women in the second/third trimester of pregnancy referring to Naghavi Professional Birth Care Center, Kashan. Given that people from different social classes refer to this clinic, this population can be considered representatives of the pregnant women population of Kashan.

Participants with known systemic diseases, those on long-term medication taking, and those who did not agree to participate in this study were excluded.

Study Design

At first, participants were interviewed using a standardized questionnaire through face-to-face interviews. The validity and reliability of the questionnaire were confirmed in previous studies.²¹ The questionnaire included demographic information, SES, oral health status, and

related behaviors. After completing the questionnaires, a trained and calibrated dentist performed a clinical examination according to the basic methods of the WHO oral health surveys.²² The examinations were performed on a conventional chair using a dental mirror and periodontal WHO probe as examination tools before the gynecologist's visit.⁶

Variables

Outcome variables were collected through oral examination, including the CPI, the clinical attachment loss (CAL), and bleeding on probing (BOP), measured during examinations. For the CPI assessment, the participant's mouth was divided into six parts (sextants), and teeth No. 11, 16, 17, 26, 27, 31, 36, 37, 46, and 47 were examined. If there were no teeth in the sequence or index teeth eligible for examination, all remaining teeth in that sequence were probed, and the highest score was recorded. In this case, the distal surface of the third molar was not scored. The CPI was scored as follows: 0 = healthy, 1 = bleeding after probing was observed directly or using a mouth mirror, 2 = a mass was found while probing, but the entire black band on the probe was visible, 3 = pocket of 4-5 mm (gingival margin within the black band of the probe), 4 = pocket of 6 mm or more (black band on the probe was not visible), 5 = X Sextant was deleted. The most significant CPI score was used for the analysis of each person.

Clinical attachment loss (CAL), defined as the distance between the tooth's cement-enamel junction (CEJ) and the pocket depth, was measured in millimeters using a WHO periodontal probe. This index was rated as follows: 0 = 0-3 mm, 1 = 4-5 mm (CEJ within the black band), 2 = 6-8 mm (CEJ between the black band and the 8.5 mm ring), 3 = 9-11 mm (CEJ between the 8.5 mm and 11.5 mm rings), 4 = 12 mm or more (CEJ beyond the 11.5 mm ring), 5 = X Sextant was deleted.

Bleeding on probing (BOP) examination was also performed at six points of the tooth surface (mesiofacial, midfacial, distofacial, mesiolingual, midlingual, and distolingual). The presence of any bleeding during the 30 seconds after probing was recorded in the chart. If the percentage of areas with BOP per person was less than 30% of all sites examined, it was defined as local inflammation. However, generalized inflammation was considered if this percentage was equal to or greater than 30%.³

Explanatory variables were collected using a structured standard questionnaire. The questionnaire included demographic and SES information, including participants' age, trimester of pregnancy (second/third), frequency of pregnancy, educational level, and SES. The information concerning oral health status and related behaviors was also gathered by questions about participants' frequency of

toothbrushing (twice a day or more, once a day, once a week, rarely, never), dental floss (twice a day or more, once a day, once a week, rarely, never), yearly dental visit (three times or more, twice, once, I have not visited any dentist in recent 12 months, I have not visited any dentist yet), cause of the last dental visit (pain, treatment, checkup), self-reported oral health and gingival health (perfect, very good, good, moderate, poor, very poor), tooth pain and discomfort in the past year, and an experience of bad taste or smell in the mouth (yes, no). For statistical analysis, answers to some variables were coded and categorized differently compared to those in the questionnaire.

Statistical Analysis

Statistical analysis and data preparation were performed via IBM SPSS statistics (version 19) software. Descriptive and bivariate statistics were analyzed using the chi-square test for qualitative variables. Moreover, the principal component analysis (PCA) was used to develop an SES measure using STATA 11.1. Since the items included both binary and continuous variables, polychoric, polyserial, and Pearson's correlations in the PCA correlation matrix were used. Then, the software divided individuals into three groups based on their SES scores using a data-driven approach.^{19,23}

Results

In 2016, PD, BOP and CAL were measured to evaluate periodontal health status and related factors in pregnant women in Kashan.

The examination was carried out on 128 pregnant women (mean age \pm standard deviation = 24.35 \pm 3.37). Most pregnant women (53.1%) were in the second trimester of pregnancy.

In this examination, 28 people (21.9%) were experiencing their first pregnancy, 62 (48.4%) were experiencing their second pregnancy, and 38 (29.7%) were experiencing their third or more pregnancy.

As reported in Table 1, the prevalence of CPI \geq 3 in the 25-34-year-old group was more than that in the 18-24-year-old group, indicating its higher frequency during pregnancy, as well as its higher frequency in the third trimester than in the second trimester of pregnancy. Perceived good or well oral health, the presence of tooth pain in the last year, not visiting a dentist, not brushing teeth every day, not using dental floss every day, gingival bleeding while brushing the teeth, poor SES, and less than 12 years of education were significantly associated with CPI \geq 3 ($P < 0.05$). Also, CPI \geq 3 was reported more among individuals with halitosis, but it was not significant. Less CPI \geq 3, CAL \geq 1, and BOP \leq 30% were

observed among women with good or well oral and gingival health ($p < 0.01$). Participants with pain or discomfort in their teeth had significantly more CPI \geq 3, CAL \geq 1, and BOP \geq 30% ($p < 0.01$). Less CPI \geq 3, CAL \geq 1, and BOP \geq 30% were observed in participants who had visited a dentist for treatment ($p < 0.01$). Also, women using toothbrushes once a day or more had significantly less CPI \geq 3, CAL \geq 1 and BOP \geq 30% ($p < 0.01$). Women who had flossed their teeth less than once a day had significantly more CPI \geq 3, CAL \geq 1, and BOP \geq 30% ($p < 0.05$). The presence of gingival bleeding while brushing was associated with more CPI \geq 3, CAL \geq 1, and BOP \geq 30% ($p < 0.01$). Additionally, women with good SES had significantly less CPI \geq 3 and BOP \geq 30% ($p < 0.01$).

Oral Health Status

Of the 128 pregnant women surveyed, 44 (34.4%) described their oral health as moderate, poor or very poor. About half of the participants cleaned their teeth every day, and one out of every four flosses their teeth every day.

Gingival health for 48 people (37.5%) was described as moderate, poor, or very poor. Toothache in the last 12 months was never or rarely experienced in 89 people (69.5%). The number of participants who had not visited a dentist in the past year was 97 (75.8%). Moreover, the last visit in 34 people (26.6%) was due to a check-up or consultation.

Among the participants, 84 (65.6%) people in the study population had bleeding gums when brushing, 61 (47.7%) complained of bad breath, and 36 participants suffered from bad breath during and before pregnancy, while 25 people (15.5%) only had this problem during pregnancy. The percentage of 4-5 mm pocket depth was 28.9%, and 6.3% had 6 mm pocket depth.

Socioeconomic Status

Approximately, one-third of the women had less than 12 years of education, and 47.7% were house owner. A majority of the women (65.5%) had a washing machine, and more than one-third had a PC or laptop.

Periodontal Status

For CPI assessment, the largest grade which was observed in the periodontium table of each participant was used and its percentage was announced.

Code 2 of the CPI value (calculus is found by probing) was the most frequent in the study population. The prevalence of periodontitis (CPI \geq 3) was detected at 35.2%. CAL was measured by its highest score in each person. The prevalence of Code 1 of CAL (from 0 to 3 mm) was 77.3% ($n = 99$), 19.6% of the study population had CAL = 4 to 5 mm ($n = 25$), and 3.1% ($n = 4$) had Code 3 of CAL (from 6 to 8 mm).

BOP was noted at least in one sextant in 94.5% (n = 121). About 50% of sextants had bleeding when probing (3.05 out of 6 sextants). Also, the most abundance of CAL was in

the code 0 (0-3 mm). The most abundant CPI was code 0, and one-third of all the teeth had Code 2 (calculus when probing).

Table 1- Evaluation of relationship between CPI, CAL and BOP index and demographic, behavioral and socioeconomic factors:

			N (%)	CPI>=3	CAL>=1	BOP<=3	
Demographic variables	Age Group	18 to 24 years old	72 (56.2)	21(29.2%)	14(19.4%)	51(70.8%)	
		25 to 34 years old	56 (43.8)	24(42.9%)	15(26.8%)	38(67.9%)	
		P-value		0.11	0.32	0.72	
	Trimester of pregnancy	Second trimester	68 (53.1)	20(29.4%)	14(20.6%)	45(66.2%)	
		Third trimester	60 (46.9)	25(41.7%)	15(25.0%)	44(73.3%)	
		P-value		0.19	0.55	0.38	
	Frequency of pregnancy	First	28 (21.9)	6(21.4%)	4(14.3%)	15(53.6%)	
		Second	62 (48.4)	23(37.1%)	14(22.6%)	43(69.4%)	
		Third	28 (21.9)	11(39.3%)	8(28.6%)	23(82.1%)	
		Fourth	10 (7.8)	5(50.0%)	3(30.0%)	8(80.0%)	
		P-value		0.30	0.57	0.11	
	Dental care behaviors	Oral health description	Weak or average	44 (34.4)	28(63.6%)	20(45.5%)	39(88.6%)
			Good or well	84 (65.6)	17(20.2%)	9(10.7%)	50(59.5%)
			P-value		<0.01	<0.01	<0.01
		Gingival health description	Weak or average	48 (37.5)	33(68.8%)	21(43.8%)	43(89.6%)
Good or well			80 (62.5)	12(15.0%)	8(10.0%)	46(57.5%)	
P-value				<0.01	<0.01	<0.01	
Pain or discomfort in teeth		With pain	39 (30.5)	31(79.5%)	26(66.7%)	34(87.2%)	
		Without pain	89 (69.5)	14(15.7%)	3(3.4%)	55(61.8%)	
		P-value		<0.01	<0.01	<0.01	
Dental Visit		None	97 (75.8)	28(28.9)	15(15.5%)	62(63.9%)	
		One time or more	31 (24.2)	17(54.8%)	14(45.2%)	27(87.1%)	
		P-value		0.008	<0.01	0.01	
Cause of last visit		Pain or treatment	94 (73.4)	33(35.1%)	22(23.4%)	93(98.9%)	
		Check up or consulting	34 (26.6)	12(35.3%)	7(20.6%)	28(82.4%)	
		P-value		0.98	0.74	<0.01	
Brushing Habit	Sometimes	63 (49.2)	38(60.3%)	27(42.9%)	58(92.1%)		
	One time a day or more	65 (50.8)	7(10.8%)	2(3.1%)	31(47.7%)		
	P-value		<0.01	<0.01	<0.01		
Flossing Habit	Sometimes	116 (90.6)	44(37.9%)	29(25.0%)	84(72.4%)		
	One time a day or more	12 (9.4)	1(8.1%)	0(0.0%)	5(41.7%)		
	P-value		0.04	0.049	0.03		
Gingival bleeding while brushing	Has	84 (65.6)	39(46.4%)	25(29.8%)	66(78.6%)		
	Doesn't have	44 (34.4)	6(13.6%)	4(9.1%)	23(52.3%)		
	P-value		<0.01	0.008	<0.01		
Halitosis	Yes and before yes	25 (19.5)	12(48.0%)	6(24.0%)	20(80.0%)		
	Yes and before no	36 (30.5)	13(36.1%)	8(22.2%)	28(77.8%)		
	No	67 (52.3)	20(29.9%)	15(22.4%)	41(61.2%)		
	P-value		0.27	0.98	0.01		
Indicators of socioeconomic status	Socioeconomic level	Weak	43 (33.6)	23(53.5%)	13(30.2%)	36(83.7%)	
		Average	43 (33.6)	14(32.6%)	11(25.6%)	33(76.7%)	
		good	42 (32.8)	8(19.0%)	5(11.9%)	20(47.6%)	
		P-value		<0.01	0.11	<0.01	
	Education (years of schooling)	Less than 12 years	41 (32.0)	24(58.5%)	14(34.1%)	34(82.9%)	
		12 years	59 (46.1)	17(28.8%)	12(20.3%)	42(71.2%)	
		More than 12 years	28 (21.9)	4(14.3%)	3(10.7%)	13(46.4%)	
P-value		<0.01	0.06	<0.01			
All			128(100%)	45(35.2%)	29(22.6%)	89(69.5%)	

Discussion

In the absence of enough epidemiologic data about the periodontal health status in pregnant women in Kashan, the purpose of this study was to determine periodontal indices in pregnancy and to assess the probable relationship between these indices and demographic and SES features of pregnant women in Kashan.

In this study, more than one-third of the statistical sample (35.2%) had periodontitis (CPI > 3); while it was 19.2% in Golpasand Hagh et al.'s study⁹, 52.6% in Yaghobi et al.'s study¹¹, and 60.3% in Torabi et al.'s study.¹⁰ The difference between the results may be due to social, cultural, and economic differences between the samples, knowledge increase, or good education level in some societies.

According to the results of this study, most of the statistical sample had BOP at least in one sextant, but bleeding after probing was observed in about half of the sextants, illustrating the presence of gingival inflammation and lack of periodontal health in most pregnant women. Gingival inflammation was caused by inadequate and insufficient brushing (50% of women in this study did not brush their teeth daily) or pregnancy complications and hormone changes. According to our previous study in 2016, more than half of the participants (64.1%) reported that they brushed their teeth once a day or more, which was far less than the pregnant women's daily brushing frequency in Finland (90%), Australia (91%), Kuwait (92%), and England (73.7%).²⁴⁻²⁷ Brushing habits in pregnancy are affected by nausea in pregnancy, which may lead to decreased frequency of habits in this stage. In contrast, in our previous study, 79.1% of the 15-25-year-old age group had BOP, which slightly decreased to 74.1% in the 25-35-year-old age group and 65.9% in the 35-44-year-old age group. Also, in Erchick et al.'s study, most (79%) pregnant women had BOP at least in one sextant.²⁸

BOP is an indicator of poor oral hygiene and is of particular importance in pregnancy when an inflammatory response to gingival bacteria is elevated.^{29,30,31} Both BOP and periodontal pockets have been shown to affect pregnancy outcomes, including increasing the chance of low birth weight and preterm birth.³¹

In this study, although CPI > 3, CAL > 1, and BOP > 30% were more frequent in the 25-34-year-old age group than in the 18-24-year-old age group, no significant relationship was found between the age and periodontal indices. This may be due to the mean young age of the study population. This finding is in accordance with Maybodi et al.'s findings.³² Previous studies have demonstrated that the prevalence and intensity of periodontitis increase with aging. Senility is a natural

process in which the host's immunity decreases, so it may cause periodontal disease. However, some believe that the increase in periodontal disease may be due to the cumulative effect of untreated disease over time.³³

CPI, BOP, and CAL increased with increasing gestational age, although this increase was not significant. However, in Tilakaratne et al.'s study, there was a significant relationship between gestational age and periodontal indices.⁸ Periodontal CPI also increased with the frequency of pregnancies, but this relationship was not significant. This finding was similar to the results of Yas et al.'s study.³⁴ This can be due to the improvement of periodontal status and oral health after pregnancy or the treatment of these diseases, so patients do not transfer periodontal problems to later pregnancies. This finding is contrary to the results of Taani et al.'s study, according to which tissue damage and destruction were shown to have a cumulative property and, therefore, the periodontal status worsened significantly after each pregnancy.⁴

In the present study, about 75.8% of pregnant women did not have a dental visit in the past year. It is necessary to perform regular dental examinations before and during pregnancy to prevent complications of oral diseases during pregnancy. Failure to visit a dentist during pregnancy can be due to the lack of knowledge, attention, or advice from doctors on dental examinations. According to the results of the present study, the prevalence of periodontal indices of CPI ≥ 3, CAL ≥ 1, and BOP ≥ 30%, was significantly higher in the individuals referring to the dentist more than once a year. Due to the fact that in this study, most of the visits to the dentist were due to pain or treatment, individuals with inappropriate periodontal status were more likely to visit a dentist. These findings are similar to those reported by Onigbinde et al.³⁵ Poor SES, low educational level, unemployment, and low income are important factors related to not having a dental visit during pregnancy.³⁶

In this study, about half of pregnant women (50.8%) brushed their teeth every day, and only about 10% of them used dental floss daily. In the present study, it was found that the frequency of brushing and flossing is significantly correlated with CPI, BOP, and CAL values. Brushing can remove microbial plaque and reduce gingivitis, which in turn can play a protective role against periodontal disease. In Golpasand Hagh et al.'s study, approximately 80% of pregnant women used toothbrushes daily, and there was a significant relationship between CPITN and toothbrush use.⁹ A similar result was reported in studies conducted by Maybodi et al.³² and Torabi et al.¹⁰

According to the results of this study, the status of periodontal CPI, BOP, and CAL values was better for pregnant women with a diploma or higher educational level. A higher educational level leads to an increased

awareness, thus improving the periodontal status. On the contrary, lower educational level can directly lead to less access to and use of dental services and neglect of oral hygiene. This finding is consistent with the results of studies conducted by Golpasand Hagh et al.⁹ In a national survey of 1985-1986 in the United States, the presence of CAL \geq 4mm or CAL \geq 7mm in at least one area of the mouth was significantly associated with educational level.³⁷ In this study, periodontal status was better in pregnant women with good SES. In the present study, CPI and BOP were found to be significantly associated with SES. However, despite the higher prevalence of CAL \geq 1 in individuals with poor SES than in those with moderate and good SES, no significant relationship was observed between CAL and SES. Gingivitis and poor oral hygiene appear to be directly related to poor SES, but there is less correlation between periodontitis and SES. In the studies of Golpasand Hagh et al.⁹ a significant relationship was observed between CPITN and SES. In the national survey of 1985-1986 in the United States, the CAL index was not related to household income.³⁷

The present study benefits from being one of the few epidemiological studies on pregnant women in Iran, although it had some limitations. The first limitation in implementation of this plan was the lack of cooperation in pregnant women in answering SES questions, which was resolved by justifying the reason for the plan, as well as its benefits and information security. The second limitation was pregnant women's reluctance to have a dental examination, which was overcome by justifying the study benefits and the fact that the examination would not harm them. Also, the individuals who entered the study were completely satisfied. The third limitation was the possibility of entering individuals with special SES that, as a result, did not represent the whole society. Since sampling was carried out in the Specialized Obstetrics and Gynecology Clinic of Kashan University of Medical Sciences, where individuals with different levels of SES visit, this problem was partially solved. The fourth limitation of the current study was the cross-sectional design, which did not allow us to study the chronological order of the risk factors and outcomes, not permitting the study of the cause and effect. It was beneficial to do

multiple regression analysis to study the association between the variable and the outcome after controlling for other covariates. However, the regression analysis was not applied in this study because of insufficient sample size.

Similar studies should be conducted in larger and more socioeconomically diverse populations over a longer period. Also, the effect of periodontal health risk factors of pregnant women on the health of the baby can be a good subject for future studies. Furthermore, investigating education through information on mass media and the Internet, distribution of brochures, and installation of posters in educational environments on the importance of oral health of pregnant mothers for mothers and babies is recommended. Studies should be conducted to evaluate the effectiveness of community-based interventions for preventing oral diseases in pregnant women.

Conclusion

The findings of this study emphasize the need to pay attention to the periodontal status of pregnant women, particularly those with low SES level. According to the results of this study, periodontal indices were significantly higher in pregnant women with poor perceptual oral health, a history of toothache, no visit to the dentist, no daily use of toothbrush and floss, low educational level, and poor SES.

Acknowledgement: We extend our gratitude to all the who participated in this study.

Author Contributions: Z.G. and M.E. and P.M.: conceived and designed the experiments; M.E. and P.M.: conducted the experiments; M.N. analyzed the data; M.E. and Z.G. and P.M.: wrote the manuscript. All authors reviewed and approved the final version.

Funding: No funding was received for this research.

Ethical Approval Code: This study was approved by the Ethics Committee in Research Affairs, School of Dentistry, Shahid Beheshti University of Medical Sciences (code: IR.SBMU.DRC.REC.1397.003).

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflict of Interest: No Conflict of Interest Declared ■

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