

The Relationship between Periodontal Disease, Preterm Delivery, and Low Birth Weight of Infants: A Case-Control Study

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Abstract

Background: Periodontal diseases, causing an infection site in the body, may be associated with a wide array of local and systemic diseases and conditions. Due to the high prevalence of periodontal disease in women, this study was conducted with the aim of determining whether periodontal disease during pregnancy is associated with premature delivery and low birth weight of the infants.

Methods: In this case-control study, the presence of periodontal disease in 115 mothers with premature birth (before 37 weeks) who had babies weighing less than 2500 grams were compared to 115 mothers with term births (after 37 weeks) and babies weighing over 2500 grams referred to the maternity hospital of Vali-e-Asr Birjand Educational-Therapeutic Center. Periodontal pocket depth, CPITN index, and gingival index were measured for 6 teeth with Ramfjord index. Data analysis was done using SPSS 16 software. The findings were described with mean \pm standard deviation and frequency distribution tables; in addition, a comparison between the two groups was made with chi-square and independent t-test.

Results: There was no difference between the two groups in terms of demographic variables. The average depth of the periodontal pocket, gingival index, as well as the index of severity and extent of periodontal disease in the case group were much higher than in the control group and these differences were statistically significant ($P < 0.05$).

Conclusion: Periodontal diseases during pregnancy increase the risk of giving birth to a premature and low birth weight baby. Therefore, it is recommended to pay more attention to the examination and treatment of periodontal diseases in pre-pregnancy care and during pregnancy.

Key Words: Cpitn index, Gingival index, Low birth weight, Periodontal disease, Periodontitis, Premature birth.

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1- INTRODUCTION

Periodontal disease is one of the chronic infections of gram-negative bacteria of the periodontal tissue (1), that lead to the destruction of bone and tooth-supporting fibers which can ultimately cause tooth loss. The prevalence of this disease in adults is 15-90% and it seems to have an increase during pregnancy (2). During pregnancy, with an increase in the amount of estrogen and especially progesterone, the permeability of blood vessels is raised, which causes swelling of the gums and an increase in the level of secretory fluid in the gum groove (3). Rising progesterone levels may reduce the keratinization of the gingival epithelium, chemotaxis, and proliferation of fibroblasts; and finally, there are changes in the subgingival flora, all of which aggravate the symptoms of gingivitis during this period (3, 4). Moreover, periodontal disease leads to the long-term local secretion of pro-inflammatory prostaglandins and cytokines, and the increase of these inflammatory mediators in the tissues (1). Therefore, periodontal disease can indirectly lead to the premature birth of babies or low birth weight babies by increasing the inflammatory mediator or direct attack of bacteria on the amnion (5).

Lifestyle factors, such as smoking and alcohol consumption, and unhealthy conditions such as diabetes mellitus, obesity, metabolic syndrome, osteoporosis, and low dietary calcium and vitamin D are common risk factors for periodontal disease (6). In low birth weight babies (<2500 grams), the mortality probability during the fetal period is 40 times higher than that in normal weight babies, and if his weight is less than 1500 grams, the mortality probability grows by a hundred times (2). LBW is associated with a group of factors including low socioeconomic status,

anemia, primiparity, short maternal height, and less than the average weight (7).

Premature birth (pregnancy duration between 28-37 weeks) is a serious perinatal event, and in general, 7-10% of babies are born prematurely, leading to death in about 75% of these cases (8). Risk factors associated with premature delivery or low birth weight babies include maternal risk factors such as age, height, weight, socio-economic status, race, smoking, alcohol consumption, mental stress, and nutritional status. Also, intervals between births, heart problems, prenatal care, maternal high blood pressure, and infection may also be important. However, the etiology of low birth weight in many infants remains unknown (9-11).

The view that placenta infection may affect preterm or low-birth-weight infants has led to increased awareness of the prevention of chronic bacterial infection in the body during pregnancy (11). One of the important reasons in the physiology of natural childbirth is the increase in the amount of prostaglandin E2 (PGE2) in the amniotic fluid, and when the amount of this prostaglandin reaches the required amount, labor and uterine contractions will occur. In the process of periodontal disease, the amount of PGE2 increases in the gingival sulcus fluid and gingival tissue. Several studies have revealed that the amount of PGE2 in the gingival groove fluid has a positive and linear relationship with its amount in the amniotic fluid; and this can indicate the possible role of gum disease in causing premature births (12).

Considering the limited and conflicting results in this regard, the present study was conducted with the aim of investigating the relationship between periodontal disease and low birth weight in newborns and premature birth among pregnant mothers.

2- MATERIALS AND METHODS

The present case-control study was conducted on 230 pregnant mothers who gave birth in the maternity hospital of Vali-e-Asr Medical Center in Birjand. The sample size of the research was estimated to be 105 women in each group based on the study of Shirinzad et al. (13). With the possibility of attrition, 115 cases (having a low birth weight (<2500 gr) and premature (< 37 week) baby) and 115 controls were included in the study using the available sampling method from eligible women; they were matched based on demographic variables. Gestational age was determined based on ultrasound results and with the approval of obstetricians and gynecologists.

Patients with systemic problems, malnutrition, periodontal treatment during pregnancy, and unwillingness to cooperate were excluded from the study. The data was collected using a checklist including demographic information, the mother's gestational age at the time of delivery, the weight of the baby at birth, and the results of individual examinations including probing depth measurement for 6 Ramfjord teeth (teeth number 16, 21, 24, 36, 41 and 44) (14, 15) and in the absence of these teeth, teeth number 11, 17, 25, 37, 42 and 45 (16).

CAL (Clinical Attachment Loss), gingival index, CPITN index, Bleeding On Probing (BOP), gingival color, gingival contour, gingival consistency are presented in Fig. 1.

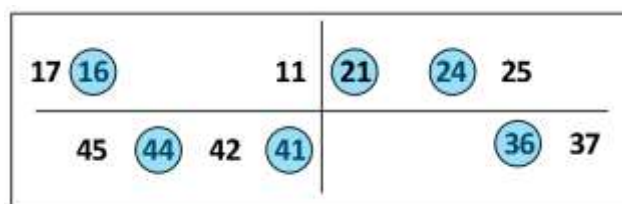


Fig. 1: Ramfjord index teeth

Then, periodontal examinations were performed using a disposable mirror, disposable catheter, and a Williams probe. The gingival index in the samples was scored based on the following criteria from 0 to 3: zero, normal gums; 1, mild inflammation, slight discoloration, slight edema without bleeding on palpation; 2, Moderate inflammation, redness, edema, glossiness, bleeding on probing or palpation; and 3, Severe inflammation, marked redness, edema, the tendency to spontaneous bleeding, and wound.

To determine therapeutic needs based on the periodontal condition of individuals, we used the CPITN index. The CPITN index was also measured as follows: normal periodontal status (code 0), bleeding on probing (code 1), dental calculus (mass above and below the gum

that causes gum irritation and inflammation) (code 2), low depth pockets (pocket up to 5 mm) (code 3), deep pockets (the pocket equal to or more than 6 mm) (code 4) (17-19).

2-1. Data Analysis

Data analysis was done with SPSS 16 software. In addition, descriptive analysis was conducted with mean, standard deviation, and frequency distribution. And, to compare the two groups in terms of different variables, the chi-square test, and independent t-test were used.

3- RESULTS

In general, 230 women were examined in this study, and the data of 115 women with premature birth and the birth of a baby weighing less than 2500 grams

in the case group as well as 115 women with term delivery and the birth of a baby weighing more than 2500 grams were analyzed in the control group. According

to the results, there was no significant difference between the two groups in terms of the gravid number and the level of education ($p < 0.05$) (**Table 1**).

Table-1: Demographic information

Variable		case	control	p-value
Age (mean± SD)		28.71±6.19	28.11±5.73	0.446
Gravid number (mean± SD)		2.34±1.27	2.30±2.30	0.785
Education (no (%))	Illiterate	4 (3.5%)	9 (7.8%)	0.262
	Elementary	27 (23.5%)	27 (23.5%)	
	Middle school degree	34 (29.6%)	29 (25.2%)	
	Diploma	30 (26.1%)	38 (33%)	
	Undergraduate	20 (17.4%)	12 (10.4%)	

Statistical tests showed that the average clinical attachment loss in the sample group (4.1) was higher than that in the control group (3.8), which were significantly different (**Table 2**).

In the statistical analysis of the gingival index, the frequency of grade 2 gingival index in the case group was significantly higher than that in the control group ($p < 0.05$) (**Table 2**).

Table-2: Comparisons of the frequency distribution (number and percentage) of mothers in case and control groups based on periodontal status indicators

Variable		Case (115)	Control(115)	p-value
CAL index (mean±SD)		4.18±1.05	3.8±0.83	0.002
Gingival index (no (%))	0	0 (0%)	0 (0%)	<0.001
	1	21 (18.3%)	59 (51.3%)	
	2	87 (75.6%)	55 (47.8%)	
	3	7 (6.1%)	1 (0.9%)	
CPITN index (no (%))	0	16 (13.9%)	24 (20.9%)	0.001
	1	12 (10.4%)	29 (25.2%)	
	2	17 (14.8%)	13 (11.3%)	
	3	60 (52.2%)	48 (41.7%)	
	4	10 (8.7%)	1 (0.9%)	

BOP between the case and control groups was compared, using the results of the gingival index. So, in the sample group, 81.7% had positive BOP (gingival index 3 and 2) and in the control group, 48.7% had positive BOP (gingival index 3 and 2), which is significantly higher in the case group than in the control group. Furthermore, no significant difference was observed in the statistical comparison of

the two case and control groups in terms of gum color and contour ($P < 0.05$). Frequencies of CPITN index in case and control groups were significantly different ($P < 0.05$) and in total 60.9% of mothers in the case group and 42.6% in the control group had periodontitis (having CPITN grades 3 and 4) (**Table 1**).

4- DISCUSSION

In the current study, a significant relationship was observed between the presence of periodontal disease in pregnant mothers and the occurrence of premature births and low birth weight babies, so that comparing the frequencies of CPITN index showed that the number of mothers with periodontal disease (with CPITN grades 3 and 4) in the case group was 1.4 times higher than that of the control group and this difference was significant (p-value < 0.001).

Also, the average loss of clinical gingival adhesion (CAL) in mothers with premature births or low birth weight babies was significantly higher than that in mothers with term births and normal birth weight babies (p-value = 0.002). This result is consistent with the results of the study by Khadem et al. (2017) (20), Turton et al. (2017) (21), Gesase et al. (22), Haerian-Ardakani et al. (23), and Vidhale et al. (24). In the study by Khadem et al., a significant relationship was found between the average depth of the gingival probe, the average gingival bleeding index, the severity and extent of periodontal disease, and the dental plaque index in the case and control groups (20). In other studies, periodontal disease was reported as a risk indicator for preterm delivery of low birth weight infants (22, 23), which is significantly associated with a higher chance of low birth weight and preterm birth (8, 24).

The results of a meta-analysis study revealed that periodontal disease may be one of the possible risk factors for low birth weight premature infants and increase the odds ratio of low birth weight infants by 2.04 to 4.19 times (25). Also, in a study by Uwambaye et al. (2021), a statistically significant relationship was observed between periodontitis and premature birth, so that the probability of premature infants being born in women who had periodontitis was 6 times higher

than that in women who did not have periodontitis (26).

There was no significant difference in the known risk factors of age, education level, and the number of pregnancies between the case and control groups. Furthermore, in the study of Khadem et al. (2012), there was no significant difference between the occupation, age, education of the individual, and the education of the spouse between the case and control groups (20). In other studies, identifiable risk factors for PLBW include high maternal age (>34 years) and young maternal age (<17 years); African-American descent; low socioeconomic status; inadequate prenatal care; drugs, alcohol, and tobacco (27). The socio-economic status of women can also affect the level of compliance with personal hygiene and the level of their use of medical care during pregnancy (27).

In addition, in the present study, there was a significant difference between the average bleeding during probing and the average loss of clinical gingival adhesion (CAL) in the case and control groups. In 2014, Shirinzad et al. also found that the average bleeding during probing, pocket depth, and pocket depth distance from the cemento-enamel junction (CEJ), in mothers whose infants weighed less than 2500 grams, were far more than those in the control group (13).

The results of this study are not in agreement with the results of the study by Ali et al. (2012) which investigated the effects of the gum condition and periodontal disease of mothers during pregnancy on pregnancy outcomes. In that study, periodontal disease was not mentioned as a risk factor for premature delivery or low birth weight babies (28). The inconsistency of the results of this study with the present one would be due to the sample size and different populations. Also, in the study by Faezi et al. (2012), no relationship was found between periodontal disease during pregnancy and

the low birth weight of the infant, but it may be related to the occurrence of premature birth (2).

In general, periodontal disease is one of the most important infectious diseases that affect the supporting structures of the teeth; and can lead to bone loss around the teeth and premature loosening of them (29). The relationship between pregnancy, gingivitis, and periodontal disease has been investigated in various studies as a potential risk factor for premature birth (20).

Although the results of most of the studies demonstrate a relationship between periodontal disease, premature birth, and low birth weight, to resolve the contradiction between the studies, more detailed studies with an appropriate sample size and a sufficient follow-up period are needed to confirm this relationship. It should also be considered that the risk of teratogenicity in the fetus caused by medical and dental procedures during pregnancy among pregnant women can cause avoidance of receiving necessary dental treatments during pregnancy. In addition, doctors and dentists are cautious in providing oral health services and often avoid treating problems related to oral health (27).

Therefore, due to the importance of this issue and the lack of knowledge and awareness among pregnant mothers and specialists such as midwives and doctors, it seems that the prevention of periodontal diseases in pregnant mothers should be prioritized by those responsible for health planning. Also, cooperation between gynecologists and obstetricians or general practitioners and periodontists should be developed to moderate this risk factor; and timely diagnosis, as well as early treatment of periodontal disease in women before and during pregnancy, will be useful, especially for women at risk (30).

5- CONCLUSION

Periodontal diseases during pregnancy increase the risk of premature and low weight birth of the infant. Therefore, it is recommended to pay more attention to the examination and treatment of periodontal diseases in pre-pregnancy care and during pregnancy.

6- ETHICAL CONSIDERATIONS

The study protocol was approved with the ethical code of IR.BUMS.REC 1399.424, at Birjand University of Medical Sciences. In order to participate in the study, written consent was obtained from all the participants, and they were also assured that the results of the study will be reported in general and without mentioning names.

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