Academia Journal of Medicine
Year 2025, Volume-8, Issue- 1 (January- June)

Maternal Chronic Periodontitis as a risk factor for preterm birth and low birth weight: A hospital-based case control study

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ARTICLE INFO

Keywords: Periodontitis, Preterm birth, Low birth weight, Pregnancy, Case-control study, CPITN.

doi:10.48165ajm.2025.8.01.8

ABSTRACT

Background: Preterm birth (PTB) and low birth weight (LBW) are main causes of neonatal morbidity and mortality worldwide. Evidence suggests a potential link between maternal chronic periodontitis and adverse pregnancy outcomes. **Objectives:** This hospital-based case-control study aimed to assess the association between maternal chronic periodontitis and the risk of preterm birth and low birth weight in postpartum women. **Methods:** A total of 540 postpartum women were enrolled, comprising 270 cases (PTB and/or LBW) and 270 matched controls (term and normal birth weight). Demographic data and obstetric history were recorded. Periodontal status was assessed using the Clinical Attachment Loss (CAL) index, Gingival Index, and Community Periodontal Index of Treatment Needs (CPITN). **Results:** No significant differences were observed between groups regarding age, gravidity, or educational status ($p > 0.05$). However, periodontal indicators were significantly worse among cases. The mean CAL score was higher in the case group (4.18 ± 1.05) than controls (3.8 ± 0.83; $p = 0.002$). Gingival inflammation and CPITN scores also showed significant differences ($p < 0.001$) **Conclusion:** Maternal chronic periodontitis is significantly associated with preterm birth and low birth weight. Early diagnosis and management of periodontal disease in pregnant women may play a role in improving perinatal outcomes.

INTRODUCTION

Maternal health conditions associated with chronic decrease in utero-placental blood flow (maternal vascular diseases, preeclampsia, hypertension, maternal smoking) are associated with poor fetal growth and nutrition [(1)]. Low birth weight (LBW) babies, defined as babies having birth weights of less than 2500g, represented disproportionately large component of neonatal and infant mortality rates. Although LBW babies make up only about 6-7% of all births, they account for more than 70% of neonatal deaths [(2)]. Infections may play an important role in prematurity [(3, 4)]. The primary mechanism is ascending infections from the vagina, which is associated to 50% of preterm birth. Other infections remote from fetal placental unity were also regarded as a potential risk factor for preterm birth [(4)].

Periodontitis is defined as an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or group of micro-organisms resulting in progressive destruction of periodontal ligament and alveolar

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bone with pocket formation, recession or both [5]. Periodontal disease is a common condition responsible for a chronic inflammatory challenge in the body. This group of diseases happens in consequence of organized biofilm present on tooth surfaces. The microbial biofilm releases substances that activate the immunoinflammatory responses of the host [6]. This challenge could trigger inflammatory mechanisms associated with preterm birth outcomes [7]. Recently, periodontal disease has been identified as a risk factor for preterm birth or low birth weight (PLBW), as bacteria from the periodontal tissues can enter the bloodstream and trigger the production of inflammatory mediators that may initiate labor and impair fetal growth.However, existing evidence remains inconclusive and changes across study groups due to differences in study design and diagnostic criteria. Therefore, there is a need for well-designed, population-specific studies to clarify this association. This study aims to assess the relationship between maternal chronic periodontitis and preterm birth/low birth weight in an Indian hospital-based setting, providing data that can inform clinical and preventive strategies in antenatal care.

MATERIAL AND METHODS

The present case-control study was conducted on 540 pregnant mothers who gave birth at a tertiary health centre. 270 cases (having a low birth weight (< 37 week) baby) and 270 controls were included in the study using and gestational age was determined based on ultrasound results and with the approval of gynecologists. Patients with systemic conditions, malnutrition, those who had received periodontal treatment during pregnancy, and individuals unwilling to participate were excluded from the study. Data collection was done using a predefined checklist that included demographic details, the mother's gestational age at delivery, birth weight of the infant, and findings from clinical examinations. Periodontal assessment included measuring the probing depth of six Ramfjord index teeth (teeth numbers 16, 21, 24, 36, 41, and 44). In cases where any of these teeth were missing, alternative teeth (numbers 11, 17, 25, 37, 42, and 45) were examined. CAL (Clinical Attachment Loss), gingival index and CPITN index were also recorded.

Periodontal examinations were conducted using a disposable mouth mirror and a Williams probe. The gingival index for each participant was recorded and scored on a scale from 0 to 3 based on the following criteria:

Score 0: Healthy gums with no signs of inflammation.
Score 1: Mild inflammation characterized by slight discoloration and edema, without bleeding upon palpation
Score 2: Moderate inflammation with redness, edema, a glossy appearance, and bleeding upon probing or palpation.
Score 3: Severe inflammation marked by pronounced redness and edema, spontaneous bleeding, and the presence of wounds.

For assessing therapeutic needs based on individuals' periodontal conditions, the CPITN index was utilized. The CPITN scores were recorded as follows:

Code 0: Normal periodontal status
Code 1: Bleeding on probing
Code 2: Presence of dental calculus (deposits above and below the gum line that leads to gum irritation and inflammation)
Code 3: Shallow periodontal pockets (depth up to 5 mm)
Code 4: Deep periodontal pockets (depth equal to or greater than 6 mm) (10-12)

Data analysis was performed using SPSS version 16 software. Descriptive statistics, including mean, standard deviation, and frequency distribution, were calculated. To compare the two groups across various variables, the chi-square test and independent t-test were applied.

RESULT

In this study, a total of 540 women were examined, with 270 women in the case group who experienced premature births and delivered babies weighing less than 2500 grams. The control group consisted of 270 women who had term deliveries and gave birth to babies weighing more than 2500 grams.

Table-1: Demographic information

Variable		Case	Control	p-value
Age (mean± SD)		28.1 ± 5.7	28.4 ± 5.6	0.63
Gravid number (mean± SD)		2.38±1.24	2.25±1.95	0.326
Education (no (%))	Illiterate	9 (3.3%)	14 (5.2%)	0.113
	Elementary	64 (23.7%)	66 (24.4%)	
	Middle school degree	80 (29.6%)	75 (27.8%)	
	Diploma	71 (26.3%)	68 (25.2%)	
	Undergraduate	46 (17.0%)	47 (17.4%)	

A total of 540 postpartum women were enrolled in this hospital-based case-control study, consisting of 270 cases and 270 matched controls. The socio-demographic characteristics of the participants are summarized in Table 1.

The mean age of mothers in the case group was 28.1 ± 5.7 years, while in the control group it was 28.4 ± 5.6 years. This difference was not statistically significant (p = 0.63), indicating comparable age distributions between the two groups. The mean gravid number was also similar between cases (2.38 ± 1.24) and controls (2.25 ± 1.95), with no statistically significant difference (p = 0.326).

Among cases, 9 (3.3%) mothers were illiterate compared to 14 (5.2%) among controls. Elementary education was reported by 64 (23.7%) participants in the case group and 66 (24.4%) in the control group. Middle school education was attained by 80 (29.6%) cases and 75 (27.8%) controls. A diploma was held by 71 (26.3%) of the cases and 68 (25.2%) of the controls. Undergraduate degrees were reported by 46 (17.0%) and 47 (17.4%) participants in the case and control groups, respectively. The overall difference in educational attainment between the two groups was not statistically significant (p = 0.113).

The findings indicate that maternal age, parity, and education levels were statistically comparable between the case and control groups. Thus, these demographic factors were not significantly associated with preterm birth or low birth weight in this population. This provides a balanced background for further analysis of maternal chronic periodontitis as an independent risk factor for adverse birth outcomes.

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	49 (18.3%)	139 (51.5%)	
	2	204 (75.6%)	129 (47.8%)	
	3	17 (6.1%)	2 (0.7%)	
CPITN index (no (%))	0	38 (14.0%)	56 (20.7%)	<0.001
	1	28 (10.4%)	68 (25.2%)	
	2	40 (14.8%)	31 (11.5%)	
	3	141 (52.2%)	113 (41.9%)	
	4	23 (8.5%)	2 (0.7%)	

Table 2 shows the comparison of periodontal health indicators between mothers in the case group (n = 270) and control group (n = 270), focusing on Clinical Attachment Loss (CAL) index, Gingival Index, and the Community Periodontal Index of Treatment Needs (CPITN).

The mean CAL index was significantly higher among cases (4.18 ± 1.05) compared to controls (3.8 ± 0.83), and this difference was statistically significant (p = 0.002). This suggests that mothers who experienced preterm birth or delivered low birth weight infants had a greater degree of periodontal tissue destruction.

The Gingival Index, used to assess the severity of gingival inflammation, also showed significant differences between the groups (p < 0.001). A majority of mothers in the case group exhibited moderate inflammation (Score 2: 204 or 75.6%) compared to 47.8% in the control group. Severe gingivitis (Score 3) was noted in 6.1% of the case group but was nearly absent in the control group (0.7%). In contrast, a greater proportion of mothers in the control group showed only mild inflammation (Score 1: 51.5%) versus 18.3% in the case group.

The CPITN index, which evaluates the need for periodontal treatment, further reinforced these findings. Higher CPITN scores were more prevalent in the case group. Notably, 52.2% of case group mothers had a score of 3 (indicating need for scaling and more intensive care), compared to 41.9% in the control group. Additionally, 8.5% of case mothers had a score of 4 (deep pockets requiring complex treatment), compared to only 0.7% among controls. These differences were statistically significant (p < 0.001), indicating a clear association between periodontal disease severity and adverse pregnancy outcomes.

These findings highlight a statistically significant and clinically relevant association between poor periodontal health and increased risk of preterm birth and low birth weight. Higher levels of clinical attachment loss, gingival inflammation, and CPITN scores were all more frequent in the case group, suggesting that maternal chronic periodontitis may serve as an independent risk factor for adverse pregnancy outcomes.

DISCUSSION

The present hospital-based case-control study investigated the potential role of maternal chronic periodontitis as a risk factor for preterm birth (PTB) and low birth weight (LBW) in a cohort of 540 postpartum women. The findings revealed statistically significant differences in periodontal health indicators between the case group (mothers who experienced PTB and/or LBW) and the control group (mothers with term, normal birth weight infants), supporting the hypothesis that poor periodontal status may be independently associated with adverse pregnancy outcomes.

Socio-demographic factors such as maternal age, gravidity, and education level were statistically comparable between the groups. These findings are consistent with previous studies suggesting that while demographic factors may influence overall maternal health, they are not consistently associated with PTB or LBW when controlling for other variables like periodontal disease [13,14].

In contrast, periodontal parameters showed significant differences between the groups. The mean Clinical Attachment Loss (CAL) was notably higher among cases, suggesting greater periodontal tissue destruction among mothers who experienced adverse birth outcomes. This aligns with the findings of Offenbacher et al. (13), who first reported an association between periodontal disease and PTB, hypothesizing that chronic maternal infections may

trigger systemic inflammatory responses contributing to preterm labor.

The Gingival Index and CPITN scores further supported this association. A larger proportion of case group mothers exhibited moderate to severe gingival inflammation and deeper periodontal pockets requiring complex treatment, compared to the control group. These findings are in agreement with those of Dörtbudak et al. and Vergnes and Sixou [15,16], who demonstrated increased prevalence of gingivitis and periodontitis in mothers of LBW and preterm infants. Systemic dissemination of periodontal pathogens and inflammatory mediators, such as prostaglandin E2 and tumor necrosis factor-α, is believed to contribute to placental inflammation and premature rupture of membranes [17,18].

Although the biological mechanism linking periodontal disease with adverse pregnancy outcomes remains complex, it is well-established that maternal infections can induce systemic inflammation. This study supports the growing evidence indicating that untreated or poorly managed periodontal disease during pregnancy may influence gestational outcomes through inflammatory pathways or hematogenous spread of oral pathogens [19].

While the current study strengthens the evidence for this association, it also highlights the importance of early screening and management of periodontal health during antenatal care. Integrating periodontal assessment into routine prenatal check-ups may be a preventive strategy to reduce the risk of PTB and LBW. However, further longitudinal studies and interventional trials are warranted to confirm causality and assess the effectiveness of periodontal treatment in improving pregnancy outcomes.

Periodontal diseases may contribute as modifiable risk factors for preterm birth. Therefore, addressing these conditions alongside other preventable risks is essential. Enhanced collaboration between obstetricians, general physicians, and periodontists is recommended. Promoting early screening and treatment of periodontal disease in women of reproductive age—both before and during pregnancy—may prove especially beneficial for those at higher risk of adverse pregnancy outcomes [20].

CONCLUSION

The findings of this study underscore the potential of maternal periodontal health as an independent risk factor for unfavorable pregnancy outcomes. Early identification and management of periodontal disease in pregnant women may represent a promising strategy to reduce the incidence of preterm birth and low birth weight. Developing maternal health programs that include oral health promotion as a component of comprehensive prenatal care and integrating periodontal evaluation into standard antenatal care to identify high-risk pregnancies early can prove to be advantageous.

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