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The relationship between maternal oral health parameters, inflammatory blood markers, and the evaluation of their effects on preterm low birth weight

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Abstract

Background Preterm birth significantly elevates neonatal mortality and morbidity, often resulting in developmental challenges and severe health consequences. Risk factor identification is essential for preventative measures. This research aimed to assess maternal oral health's effects on inflammatory blood markers and determine a possible relationship with preterm low birth weight (PLBW).

Methods This study employed a cross-sectional and case-control design. A randomized cohort of fifty women who delivered low-birth-weight infants was compared to a matched control group of fifty women who delivered full-term infants. Oral health was evaluated using the DMFT (Decayed, Missing, and Filled Teeth), DMFS (Decayed, Missing, and Filled Surfaces), Plaque Index (PI), Gingival Index (GI), Pocket Depth (PD), and Clinical Attachment Level (CAL). Patient history and relevant hematological data were retrieved from medical records. Logistic regression modeling was conducted on variables exhibiting statistical significance ($p < 0.05$) following group comparisons.

Results The case group showed significantly higher oral health indices than the control group, with median DMFT scores of 7.14 vs. 4.74 ($p = 0.013$), DMFS scores of 20.58 vs. 12.08 ($p = 0.026$), PI values of 1.96 vs. 1.18, GI values of 2.03 vs. 1.20, and PD values of 2.61 mm vs. 2.00 mm (all $p < 0.001$). However, none of these parameters (DMFT, DMFS, PI, GI, or PD) were significant predictors of PLBW ($p > 0.05$). Weak positive correlations were observed between PI, GI, PD, and leukocyte counts ($r = 0.240$, $p = 0.016$; $r = 0.248$, $p = 0.013$; and $r = 0.220$, $p = 0.028$, respectively).

Conclusions Considering the study's limitations, the principal results suggest a statistically significant difference in oral health, with women delivering low birth weight infants exhibiting poorer outcomes than control groups. Analysis of secondary outcomes indicates that oral health is not an independent predictor of preterm birth; instead, its contribution may be indirect and through systemic inflammation. Effective collaboration between obstetricians and dentists is crucial for the early detection and management of oral health issues in pregnant patients. Prioritizing the creation of public health policies designed to reduce the incidence of preterm births and strengthen maternal-fetal well-being is essential.

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Keywords Complete blood counts, Low birth weight, Oral health, Preterm birth

Introduction

Parturition prior to the thirty-seventh week of gestation is classified as preterm birth. A neonatal weight of less than 2.5 kg constitutes low birth weight (LBW), a condition often associated with preterm delivery [1]. Neonates with preterm low birth weight (PLBW) demonstrate elevated mortality rates, developmental disabilities, and a greater prevalence of comorbid conditions when compared to their term-born counterparts. Neonates born prematurely often present with immature organ systems, increasing their susceptibility to complications, including respiratory distress syndrome, intraventricular hemorrhage, and sepsis. Moreover, premature LBW infants exhibit a heightened mortality risk compared to their non-premature counterparts. The etiology of preterm birth is frequently multifactorial and remains incompletely elucidated. Preterm birth has been linked to a multitude of risk factors, including maternal infections, placental abnormalities, multiple gestations, genetic predispositions, and environmental influences [2, 3].

The oral disease periodontitis is distinguished by progressive damage to the supporting structures of the teeth, culminating in the loss of the periodontal attachment apparatus and alveolar bone. Periodontal pockets and/or gingival recession are its characteristic features. A strong correlation has been extensively documented between periodontal disease and systemic health problems. This relationship is posited to result from factors including systemic dissemination of periodontal pathogens and the release of local inflammatory mediators [4]. The prevalent oral disease known as dental caries is a demineralization process affecting the hard tissues of teeth. The lack of treatment, especially with pulp involvement, risks subsequent inflammation, tooth loss, and negative consequences for pregnancy [5].

The presence of oral periodontitis-associated pathogens may contribute to placental inflammation and the initiation of infections within the fetoplacental unit or through hematogenous dissemination. The precise mechanisms underlying these processes and their potential contribution to negative pregnancy outcomes require further elucidation. Clarifying the pathways linking periodontal infections to placental and fetal health necessitates additional research. Despite extensive research, a definitive conclusion regarding the direct correlation between periodontal disease and adverse pregnancy outcomes remains elusive. Studies investigating the association between oral health and adverse pregnancy outcomes have yielded conflicting conclusions, precluding a conclusive determination of a direct relationship [6–12]. Complete blood count (CBC) parameters, owing to their affordability and non-invasive nature, are widely accepted as valuable indicators of systemic inflammation, making CBC a crucial tool for monitoring maternal health throughout pregnancy [13].

Preterm birth and low birth weight are associated with significant health complications, including increased neonatal mortality and morbidity, underscoring the critical need for the identification of risk factors. While extant literature has predominantly focused on oral health issues such as periodontal diseases and dental caries, the underlying etiopathogenesis and interrelationships among these conditions remain unelucidated. A notable lacuna in the existing literature pertains to the role of oral health and its relationship with systemic inflammatory markers in women who deliver low birth weight infants. The present study aims to provide a novel perspective on the etiopathogenesis of these conditions by examining the effects of oral health on preterm labor and low birth weight, as well as the potential associations with systemic inflammatory markers.

This study's null hypothesis proposed the absence of a significant difference in oral, dental, and inflammatory blood parameters between the low-birth-weight infant group and the control group.

This study aimed to investigate a potential correlation between the oral and dental health of mothers who delivered low-birth-weight infants and systemic inflammatory biomarkers, MPV/PLT (Mean Platelet Volume/Platelet Ratio), PLR (Platelet-Lymphocyte Ratio), MLR (Monocyte-Lymphocyte Ratio), NLR (Neutrophil-Lymphocyte Ratio), leukocyte count, MPV (Mean Platelet Volume), and PCT (Plateletcrit). The findings were compared to the results obtained from women with full-term deliveries.

Methods

Ethical approval and study design

The Non-Interventional Ethics Committee of Niğde Ömer Halisdemir University Faculty of Medicine approved the research, with the decision recorded under Approval Number 2022/17. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. A research design combining both case-control and cross-sectional methodologies was utilized.

Study population and sampling

The study population consisted of women who delivered at the Niğde Ömer Halisdemir University Training and Research Hospital's Department of Gynecology and

Obstetrics from March 2022 to January 2023. Eligible participants were women aged 18–35, carrying a single fetus, and without any pre-existing systemic conditions. The study cohort consisted of 50 women who delivered infants classified as premature and low birth weight (PLBW), defined as birth at or before 36 weeks gestation and a birth weight below 2.5 kg. In comparison, the control group consisted of 50 age-matched women who gave birth to full-term infants (≥ 37 weeks) with birth weights of 2.5 kg or greater [1]. All participants provided written informed consent.

Sample size determination

G*Power analysis was utilized to determine the requisite sample size. Following Vidhalea et al.'s study, a significance level (alpha) of 0.05, a statistical power of 0.80, and an effect size of 0.5 were utilized. As a result, a minimum of 51 participants per group, with equal allocation across groups, was calculated [14].

Inclusion and exclusion criteria

Study exclusion criteria encompassed systemic illnesses (diabetes mellitus, renal failure, genitourinary infections), prior chorioamnionitis, age beyond the 18–35 year range, multiple pregnancies or in vitro fertilization conceptions, cervical incompetence, pre-eclampsia, chronic infections, less than 20 teeth, and dental misalignment. Furthermore, participants who had used non-steroidal anti-inflammatory drugs, antibiotics, or mouthwash within the preceding six months or had undergone periodontal therapy within the previous three months were excluded.

Hematological parameters

Venous blood samples were obtained within 24 h preceding the labor initiation. Hematological parameters were determined via complete analysis of collected blood samples, including MPV/PLT ratio, PLR, NLR, leukocyte count, MPV, and PCT [13].

Maternal and neonatal data collection

Comprehensive maternal and neonatal characteristics were ascertained by administering a structured questionnaire. The maternal dataset contained demographic variables: age, educational attainment, pre-pregnancy Body Mass Index (BMI) and prenatal BMI. Records included a detailed obstetric history, specifying parity, gestational ages at birth, birth weights, history of preterm deliveries, interpartum intervals, and maternal weight gain during each pregnancy. Information was gathered regarding participants' use of medications, consumption of coffee, tobacco and alcohol use, and oral hygiene practices such as brushing frequency and use of supplemental oral hygiene tools. The neonatal data encompassed evaluations of the infant's gender, birth weight, length, head circumference, Apgar scores, sepsis incidence, respiratory support requirement, and admission to the neonatal intensive care unit (NICU). Postnatal assessment of immediate neonatal physical status was conducted via Apgar scoring at one and five minutes post-partum [13].

Oral examination

Dental and periodontal examinations were performed on parturient women admitted to the maternity ward. Initial assessments were performed within 24 h postpartum, followed by a second set of measurements 24 h post-assessment. All procedures strictly followed a standardized protocol, independent of patient medical records. Patients maintained a supine posture for all examinations, and verbal directions were given to achieve appropriate head positioning. The evaluation process was carried out under conditions of portable lighting [13].

Dental examination

Caries assessment employed the DMFS index, focusing on the condition of individual tooth surfaces, while the DMFT index provided a whole-tooth assessment of caries. Both indices conformed to the World Health Organization's established standards for quantifying dental caries prevalence and severity at individual and population levels [13]. A single specialist dentist (ADD) performed all dental examinations using standardized mouth mirrors and probes.

Periodontal examination

Periodontal assessments incorporated evaluations of the periodontal index (PI), gingival index (GI), probing depth (PD), and clinical attachment level (CAL) [13]. Probing depth (PD) measures the distance from the gingival margin to the sulcus or pocket base, whereas clinical attachment level (CAL) measures the distance from the cementoenamel junction (CEJ) to the sulcus or pocket base. Periodontal measurements were obtained using a manual periodontal probe (Williams probe, Hu-Friedy, Chicago, IL, USA), with six sites measured per tooth. All periodontal assessments were conducted by a specialist dentist (SND).

Measurement reliability

Reliability and consistency were assessed using correlation analyses on paired datasets provided by each specialist dentist (ADD and SND).

Statistical analysis

Data analysis was performed using SPSS version 23.0 (SPSS Inc., Chicago, IL). Kolmogorov-Smirnov test was used to evaluate the normality of data distribution,

Table 1 Distribution of demographic features of the groups

	CASE GROUP	CONTROL GROUP	*p*
BMI(First)[b]	23.45±6.61	23.84±3.72	0.809
BMI(End)[b]	27.41±7.51	29.34±3.78	0.191
Child			
Male/female[c]	29/21	21/29	0.110
Age[c] (year)	26.48±5.83	27.44±6.30	0.614
Education Level[c]			
No	5	0	0.058
Primary school	22	22	
High school	16	14	
University	7	14	
Number of Births[b]	2.36±1.20	2.14±1.26	0.291
Gestasyonel week[b]	34.48±2.21	39.28±1.01	**<0.001**
Time Since Last Birth[b] (year)	1.98±1.70	1.82±1.82	0.590
Weight gained during[a] (year) **Pregnancy** (kg)	9.72±5.66	14.48±5.02	**<0.001**
Type of Birth[c]			
Normal	14	30	
C/S	36	20	
Coffee[c]			1.000
Drinks	40	40	
No Drinks	10	10	
Previous Premature Birth[c]			
No	39	46	0.050
Yes	11	4	
Cigarette/alcohol[c]			0.505
No	44	46	
Yes	6	4	
Non-Brush Oral Care[c]			
No	44	49	0.026
Mouthwash	6	0	
Floss	0	1	
Brushing Frequency[b]	0.66±0.77	0.88±0.74	0.122
Drug Use[c]			0.341
No	46	45	
Levothyroxine	4	3	
Aspirin/DMAH	0	2	
Baby Size[b] (cm)	45.86±3.14	50.38±1.38	**<0.001**
Baby Weight[b] (gr)	2195±336.54	3301±347.51	**<0.001**
Baby Head Circumference[b] (cm)	32.5±1.88	35.44±2.55	**<0.001**

Data presented as mean SD or number of patients (%). [a] Student-T test; [b]Mann–Whitney U-test; [c]Pearson's 2–test; [d] Fisher's exact test

Statistically significant inter-group differences ($p<0.05$) *

taking into account the sample number. Mann-Whitney U test was used for between-group comparisons of data that did not conform to a normal distribution. Student's t-test was used for between-group comparisons of data that conformed to a normal distribution. Categorical variables were analyzed using Pearson's chi-square test. Mean ± SD was used for normally distributed data and median (min-max) values were used for non-normally distributed data. Hierarchical binary logistic regression was utilized for further analysis of statistically significant variables. Intra-reviewer reliability for quantitative data was assessed using the Intraclass Correlation Coefficient (ICC). A p-value threshold of 0.05 was denoted statistical significance.

Table 2 Comparison of oral health indices between case and control groups

Oral Indices	CASE GROUP *N*=50	CONTROL GROUP *N*=50	*p*-value
DMFT	7.14 (0–28)	4.74 (0–20)	**0.013**[1]
DMFS	20.58 (0-125)	12.08 (0–77)	**0.026**[1]
PI	1.96 (1.21–2.79)	1.18 (0-2.01)	**<0.001**[1]
GI	2.03 (1.36–2.81)	1.2 (0-2.25)	**<0.001**[1]
PD	2.61 (1.9–3.33)	2.00 (1.42–2.8)	**<0.001**[1]
CAL	1.62 (0–18)	0.56 (0–6)	**0.114**[1]

Median (Min-Max); [1] Mann-Whitney U test

DMFT (Decayed, Missing, Filled Teeth), DMFS (Decayed, Missing, Filled Surfaces), (PI) Plaque Index, (GI) Gingival Index, (PD) Pocket Depth, (CAL) Clinical Attachment Level

Results

The study comprised 100 female participants, with 50 assigned to the case group and 50 to the control group. No statistically significant intergroup differences were observed for age, educational attainment, pregnancy status, or pre-pregnancy BMI ($p=0.614$, $p=0.058$, $p=0.809$, and $p=0.191$, respectively). Likewise, no statistically significant variations were detected in delivery frequency, interdelivery intervals, or prior preterm birth history ($p=0.291$, $p=0.590$, and $p=0.050$, respectively). Conversely, a statistically significant reduction in gestational weight gain ($p<0.001$) and a statistically significant increase in cesarean deliveries ($p=0.001$) were observed in the case group. Intergroup comparisons revealed no statistically significant differences in smoking habits, alcohol consumption, coffee intake, oral hygiene practices (including brushing frequency), or medication use ($p=0.505$, $p=1.000$, $p=0.026$, $p=0.122$, $p=0.341$, respectively). No statistically significant gender-based differences were observed in infant characteristics ($p=0.110$); however, infants in the case group exhibited significantly lower height, weight, and head circumference ($p<0.001$). Thirteen neonates in the study cohort exhibited Apgar scores ranging from 5 to 6 at birth, necessitating transfer to a specialized neonatal unit and respiratory support ($p<0.001$) (Table 1). Analysis of oral indices revealed significantly elevated DMFT, DMFS, PI, GI, and PD scores in the case group compared to the control group ($p<0.05$) (Table 2).

Regression analysis examined the independent predictive capacity of statistically significant clinical and laboratory findings, differentiating case and control groups to predict PLBW. The analysis incorporated DMFT, DMFS, PI, GI, and PD indices. For each variable, the model generated regression coefficients (B), odds ratios (OR), p-values, and 95% confidence intervals (CI). Regarding DMFT, the odds ratio of 0.997 ($p = 0.989$, 95% confidence interval: 676–1471) indicated no significant association with PLWB. Likewise, DMFS exhibited an odds ratio of 1.036 ($p = 0.504$, 95% CI = 0.933–1.151), indicating a lack of predictive value. PI had an OR of 2.654 ($p = 0.081$, 95% CI = 886–7964), suggesting a trend towards association, although not statistically significant. GI and PD yielded odds ratios of 1.251 ($p = 0.697$, 95% CI: 404–3876) and 1.326 ($p = 0.378$, 95% CI: 708–2485), respectively, neither indicating a statistically significant association (Table 3).

Assessing the relationship between clinical findings and inflammatory markers (PI, GI, PD, and leukocyte levels) revealed weak positive correlations ($p = 0.016$, $p = 0.013$, $p = 0.028$, respectively). The analysis revealed no statistically significant relationship between the other markers and examination findings (Table 4).

Statistically significant elevations in MPV/PLT, MPV, PCT, and leukocyte levels were observed in the case group compared to the control group ($p < 0.001$, $p = 0.002$, $p = 0.001$, and $p = 0.012$, respectively) (Table 5).

Table 3 Results of the binary logistic regression model determining the relationships among various clinical or laboratory factors and preterm delivery in patients

	B	OR	*p*	95% CI
DMFT	-003	0.997	0.989	676–1471
DMFS	036	1.036	0.504	933–1151
PI	976	2.654	0.081	886–7964
GI	224	1.251	0.697	404–3876
PD	282	1.326	0.378	708–2485

Odds ratios with associated 95% CIs are provided for each category;

an OR with 95% CI not in

Median (Min-Max);[1]*Mann-Whitney U test*

DMFT (Decayed, Missing, Filled Teeth), DMFS (Decayed, Missing, Filled Surfaces), Plaque Index (PI), Gingival Index (GI), Pocket Depth (PD), Clinical Attachment Level (CAL)

Quantitative data analysis yielded ICCs ranging from 0.85 to 0.95, indicating highly reliable and reproducible results.

Discussion

Currently, there is a lack of research examining the relationship between maternal oral and dental health, circulating inflammatory markers, and the incidence of preterm birth and low birth weight. The study's conclusions are anticipated to contribute to a clearer understanding of the link between the systemic implications of oral and dental health and the etiopathogenesis of PLBW.

Table 4 Correlations of maternal oral health examination findings with inflammatory laboratory values. *(MPV/PLT), platelet volume/Platelet, (PLR) platelet/lymphocyte ratio, (MLR) Monocyte/Lymphocyte, (NLR) neutrophil/lymphocyte ratio, mean platelet volume (MPV), plateletcrit (PCT)*

		DMFT	DMFS	PI	GI	PD	CAL
MPV/PLT	Correlation	-0.071	-0.104	-0.224*	-0.202*	-0.189	-0.023
	Coefficient p	0.482	0.302	0.025	0.044	0.059	0.822
PLR	Correlation	0.1451	0.1091	-0.0767	0.1203	-0.2310	-0.0252
	Coefficient p	0.1499	0.2798	0.5967	0.4055	0.1065	0.8618
MLR	Correlation	0.069	-0.094	0.052	0.072	0.023	0.022
	Coefficient p	0.494	0.351	0.607	0.478	0.817	0.825
NLR	Correlation	0.011	-0.002	0.093	0.120	0.053	0.064
	Coefficient p	0.917	0.986	0.357	0.235	0.602	0.525
MPV	Correlation	-0.1496	-0.1117	0.0251	0.0291	0.1582	0.0369
	Coefficient p	0.1373	0.2687	0.8628	0.8411	0.2726	0.7993
PCT	Correlation	0.014	0.037	0.147	0.133	0.088	-0.014
	Coefficient p	0.890	0.717	0.146	0.186	0.386	0.888
Leukocyte	Correlation	-0.085	-0.085	0.240*	0.248*	0.220*	0.010
	Coefficient p	0.398	0.399	**0.016**	**0.013**	**0.028**	0.925

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

Table 5 Blood counts of subjects and relationship between case and control gruops

Blood Counts	CASE GROUP *N* = 50	CONTROL GROUP *N* = 50	*p*-value
MVP/PLT	0.043 (0.02–0.07)	0.056 (0.02–0.13)	**< 0.001**[2]
PLR	130.93 (70.51-298.97)	116.33 (55-198.70)	0.174 [2]
MLR	0.35(0.19–0.85)	0.32 (0.03–0.50)	0.572 [2]
NLR	4.45(2.13–12.69)	3.91 (1.75–11.32)	0.217 [2]
Leukocyte	11.94 ± 2.96	10.02 ± 3.12	**0.002**[1]
MPV	10.61 (8.90-12.71)	11.30 (8.50–13.50)	**0.001**[2]
PCT	0.27(0.16–0.51)	0.24 (0.14–0.43)	**0.012**[2]

[1]Mean ± SD; [2]Median (Min-Max); [1] Student T test [2] Mann-Whitney U test,

(MPV/PLT), Platelet Volume/Platelet, (PLR) Platelet/lymphocyte ratio, (MLR) Monocyte/Lymphocyte, (NLR) Neutrophil/lymphocyte ratio, Mean Platelet Volume (MPV), Plateletcrit (PCT)

This study revealed statistically significant variations in oral health metrics (DMFT, DMFS, PI, GI, PD) and hematological markers (MPV/PLT, MPV, PCT, and leukocyte count) between the case and control cohorts. These differences, however, were deemed insignificant predictors of preterm birth and low birth weight (PLBW) in the regression analyses conducted.

Alternatively, the literature reveals an association between periodontal diseases and the incidence of preterm birth or low birth weight. Notably, a correlation has been observed between periodontitis and preterm birth, with some research suggesting up to a sixfold increase in risk [9]. Moreover, a deficiency in vitamin D, in conjunction with inadequate oral hygiene, has been documented as a contributing factor to preterm birth and low birth weight [11]. Notwithstanding, several studies refute this association, reporting no statistically significant relationship between periodontal diseases and preterm birth [10].

Unlike this study's findings, other research has indicated no association between dental caries and preterm birth [5–7]. Nevertheless, a substantial correlation between tooth loss and premature birth has been highlighted in the literature [6]. The disparate findings across studies may result from methodological variations, specifically in the diagnosis of the disease, the criteria used to define preterm birth, and the measurement of infant weight. This study's population comprised women who experienced preterm births and delivered infants with birth weights under 2.5 kg.

This study corroborates the established understanding that preterm birth is a multifaceted event resulting from the interaction of numerous factors, encompassing medical conditions (e.g., anemia, infertility, pre-existing diabetes), psychosocial and behavioral factors (e.g., depression, smoking, substance abuse), and pregnancy-related complications (e.g., premature rupture of membranes, multiple gestations, antepartum hemorrhage) [15–17]. The significance of oral health as a marker for periodontal disease is notable, given its potential to induce inflammatory responses impacting fetomaternal circulation and potentially leading to preterm birth [18]. The literature, however, suggests the insufficiency of a single biomarker or clinical parameter for predicting preterm birth owing to its multifactorial nature [18, 19]. A systematic review indicated that the pathophysiology of preterm birth is multifactorial, encompassing infection/inflammation and uteroplacental ischemia, thus necessitating a comprehensive risk factor assessment [18, 19]. Furthermore, preterm birth has been linked to maternal characteristics (sociodemographic, obstetric, and psychological) as well as paternal and environmental influences. Nevertheless, the study's conclusions may be limited by the uncontrolled confounding effects of maternal lifestyle, maternal psychological conditions, and antepartum hemorrhage, impacting oral health and pregnancy outcomes [15, 20].

The study results emphasize the critical need to control for confounding factors in evaluating the relationship between maternal oral health and preterm birth. Interestingly, this study revealed a weak, positive correlation between periodontal indices (PI, GI, and PD—key indicators of periodontal inflammation and status) and leukocyte counts. The findings of this study support the understanding that periodontal bacteria and their associated by-products can breach tissue barriers and enter systemic circulation or have systemic effects [21, 22]. As an example, a study by Özdemir et al. [23] revealed significantly higher concentrations of DNI (immature neutrophil ratio), CRP (C-reactive protein), neutrophils, and leukocytes among patients diagnosed with periodontitis. Consistent with the foregoing, a meta-analysis established a link between periodontitis and changes in hematological markers, such as elevated leukocyte and neutrophil counts and higher erythrocyte sedimentation rates [24].

Severe periodontitis has been linked to systemic inflammation through the action of proinflammatory mediators, which stimulate hepatic responses and increase C-reactive protein levels [25]. Overall, the study's results corroborate established processes and provide further evidence illuminating the relationship between systemic inflammation and periodontal health. Consequently, these results emphasize the crucial role of early identification and effective treatment of periodontal

inflammation, especially within the context of pregnancy or pregnancy planning in women.

CBC results demonstrated statistically significantly higher levels of MPV/PLT, MPV, PCT, and leukocytes in the case group compared to the control group. The literature exhibits considerable heterogeneity for these parameters. For example, a reduction in MPV levels in individuals with preterm birth has been reported by Kurban et al. [26]. In contrast, Khatoon et al. reported no elevation in neutrophil counts amongst women experiencing preterm birth and no statistically significant variations in NLR, lymphocyte-to-monocyte ratio (LMR), or PLR [27]. Furthermore, a separate study revealed statistically significant variations in these biomarkers between preterm and term birth cohorts, most notably the neutrophil-to-lymphocyte ratio (NLR), hemoglobin (HGB), and platelet distribution width (PDW), indicating their potential utility in early preterm birth prediction [28]. Discrepancies might have resulted from study design variations, participant demographics, or methodological procedures. The variability in the blood parameters assessed and the discrepancies in the results obtained across studies indicate that these biomarkers may not explain the observed association completely.

The effective translation of these parameters into clinical practice necessitates further study. In addition, studies reveal a greater likelihood of serious illness in infants with low birth weight for gestational age, often necessitating advanced medical care, including neonatal intensive care, mechanical ventilation, and supplemental oxygen [29]. Correspondingly, thirteen preterm infants in this study required respiratory support and neonatal intensive care; the observed low Apgar scores in this group suggest a higher incidence of health complications, leading to greater resource consumption. Negative neonatal outcomes may result from inadequate maternal oral and dental health due to potential systemic inflammation, thereby highlighting the critical need for improved monitoring and management of maternal oral health throughout pregnancy.

This study's significant contributions include its analysis of periodontal and dental health in PLBW and its utilization of the CBC test as a non-invasive and efficient method for assessing inflammatory markers, providing valuable insights into the pathogenesis of PLBW.

Among the study's notable strengths is the comprehensive evaluation of maternal periodontal and dental health in the context of preterm low birth weight (PLBW). Implementing CBC tests in assessing inflammatory markers emerged as a significant advantage, as it proved an effective and non-invasive approach. Furthermore, the study's exploration of the association between oral health and systemic inflammation and its potential contribution to the etiology of preterm birth has led to significant advancements in the field and has yielded valuable insights.

The study is not without its limitations. The bedside method of intraoral examinations is inherently limited in detecting minute variations in hard and soft tissue structures, as it relies on subjective clinical judgment, thus having reduced sensitivity compared to advanced diagnostic tools such as radiographic imaging or molecular analyses. The study's restriction to a single center limited the generalizability of the findings, and it did not consider potential variations due to geographical, cultural, or socioeconomic factors. Furthermore, uncontrolled variables such as lifestyle factors, maternal nutrition, stress, and access to antenatal care might have influenced the observed associations. The cross-sectional design precluded the assessment of cause-and-effect relationships between oral health, systemic inflammation, and preterm birth. Finally, the absence of a comprehensive analysis of microbial factors, such as systemic inflammatory markers (e.g., cytokines) or specific periodontal pathogens, precluded a more nuanced understanding of mechanisms underlying the relationship between oral health and preterm birth.

Future studies should employ advanced diagnostic methods (e.g., radiographic imaging, molecular analyses) to enhance our understanding of the association between preterm birth and low birth weight and oral health. These studies should be conducted in multicenter settings, encompassing diverse populations, and should control for lifestyle factors such as maternal nutrition, stress, and prenatal care. Additionally, longitudinal prospective designs should further elucidate the relationship between preterm birth and low birth weight and oral health. In addition, a thorough examination of inflammatory markers (e.g., cytokines, CRP) and particular periodontal pathogens may facilitate a more comprehensive elucidation of the biological mechanisms underlying the association between preterm birth and low birth weight and oral health.

Conclusion

Within the study's limitations, primary outcomes revealed that the oral health of women delivering preterm low birth weight (PLBW) babies was worse compared to the control group. However, these parameters were not found to independently predict preterm delivery. Secondary outcomes demonstrated that the impact of poor oral health on peripheral blood values supports the role of systemic inflammation in the etiology of preterm birth. These findings highlight the indirect effect of oral health on pregnancy outcomes. Healthcare providers should conduct routine oral health assessments throughout pregnancy to facilitate timely identification and treatment of potential problems, leveraging a collaborative

strategy with obstetricians and dentists. Incorporating oral health assessments into routine prenatal care, providing enhanced access to dental services, and developing public health policies to promote awareness of oral health during pregnancy are crucial. Implementing these measures can potentially reduce risk factors associated with preterm birth and improve maternal and fetal health outcomes.

Abbreviations

PLBW	Preterm Low Birth Weight
DMFT	Decayed, Missing, Filled Teeth
DMFS	Decayed, Missing, Filled Surfaces
PI	Plaque Index
GI	Gingival Index
PD	Pocket Depth
CAL	Clinical Attachment Level
CBC	Complete blood count
WHO	World Health Organization
MPV/PLT	Platelet Volume/Platelet
PLR	Platelet/lymphocyte ratio
NLR	Neutrophil/lymphocyte ratio
MPV	Mean Platelet Volume
MLR	Monocyte/Lymphocyte
PCT	Plateletcrit
BMI	Body Mass Index

Author contributions

IT: contributed to study design, data collection, interpretation, and writing of the manuscript KTT: contributed to the study design and statistical analysis. SND and AND: contributed to data collection. MK: contributed to the statistical analysis.All authors reviewed the manuscript.

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Data availability

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Declarations

Ethics approval and consent to participate

Study approval statement: The Non-Interventional Ethics Committee of the Faculty of Medicine of Niğde Omer Halisdemir University approved the study with decision number 2022/17. This study was conducted in accordance with the principles of the Declaration of Helsinki (https://www.wma.net/policies-post/wma-declaration-of-helsinki/).

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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