

# Periodontal evaluation of pregnant women after delivery: a cross sectional study

## Avaliação periodontal de gestantes após parto: estudo transversal

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### Abstract

**Introduction:** The association between periodontal status and adverse pregnancy outcomes has been studied since 1990 with conflicting results. Premature birth and low birth weight babies were the two main concerns addressed by the investigations, related to periodontal disease. **Objectives:** The present study investigated the prevalence of periodontal disease in women in the postpartum period seen at a public hospital in the southern region of the city of São Paulo and the assessment of a possible relationship between periodontal disease and the frequency of prematurity and low birth weight. **Casuistry and Methods:** This is a cross-sectional study that selected pregnant women attended for delivery in a public hospital, and verified the possible association between periodontal disease and the number of preterm births and low birth weight babies. The periodontal examination, including bleeding on probing and plaque index, was performed within 48 hours after delivery by the same examiner on all teeth at six locations per tooth using a Marquis periodontal probe. The data were analyzed using the Kruskal-Wallis and chi-square tests, at the level of statistical significance  $\alpha = 0.05$ . **Results:** During the study period, 109 mothers were examined, 13 of whom had babies weighing less than 2,500 g, 8 of whom were less than 37 weeks pregnant; among those of normal weight, there were another 6 newborns, totaling 14 babies with shorter gestation times. Only 7 mothers had periodontal health, with gingivitis and periodontitis predominating, respectively, in 50 and 52 mothers. There was no association with mean age, number of prenatal visits, gestational age, weight and length of the baby. There was also no association with health history data, especially diabetes, hypertension and smoking. **Conclusions:** The incidence of prematurity and low birth weight was considered low and was not associated with maternal periodontal status.

**Keywords:** gingivitis; periodontitis; premature; low birth weight.

### Resumo

**Introdução:** A associação entre o estado periodontal e os resultados adversos da gravidez tem sido estudada desde 1990 com resultados discrepantes. Parto prematuro e bebês com baixo peso ao nascer foram as duas principais preocupações abordadas pelas investigações,

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relacionadas à doença periodontal. **Objetivos:** O presente trabalho investigou a prevalência da doença periodontal em mulheres no período pós-parto atendidas em hospital público da região sul da cidade de São Paulo e a avaliação de uma possível relação entre doença periodontal e frequência de prematuridade e baixo peso ao nascer. **Casuística e Métodos:** Trata-se de um estudo transversal que selecionou gestantes atendidas para a realização do parto em um hospital público, e verificou-se a possível associação entre doença periodontal e o número de partos pré-termo e bebês com baixo peso. O exame periodontal, incluindo sangramento à sondagem e índice de placa, foi realizado dentro de 48 horas após o parto pelo mesmo examinador em todos os dentes em seis locais por dente usando uma sonda periodontal Marquis. Os dados foram analisados pelos testes de Kruskal-Wallis e qui-quadrado, ao nível de significância estatística  $\alpha = 0,05$ . **Resultados:** Durante o período de estudo, foram examinadas 109 mães, das quais 13 tiveram bebês com menos de 2 500 g, sendo 8 com menos de 37 semanas de gestação; entre aqueles com peso normal, foram outros 6 recém-nascidos, totalizando 14 bebês com tempo de gestação menor. Apenas 7 mães tinham saúde periodontal, predominando assim a gengivite e a periodontite, respectivamente, em 50 e 52 mães. Não houve associação com idade média, número de consultas pré-natais, idade gestacional, peso e comprimento do bebê. Também não foi encontrada associação com dados do histórico de saúde, especialmente diabetes, hipertensão e tabagismo. **Conclusões:** A incidência de prematuridade e baixo peso ao nascer foi considerada baixa e não esteve associada ao estado periodontal materno. **Palavras-chave:** gengivite; periodontite; prematuro; baixo peso ao nascer.

## Introduction

The association between periodontal status and adverse pregnancy outcomes has been studied since the 1990s, with discrepant results. Preterm births (PTB), delivery before 37 weeks of pregnancy, and infants with low birth weight (LBW), weight less than 2,500 g, have been the two main concerns addressed by investigations<sup>1-5</sup>.

Increased levels of pro-inflammatory cytokines and specific periodontal pathogens have been implicated in PTB and/or infants with LBW<sup>5,6</sup>. Case-control studies or the use of more advanced statistical techniques, with varying sample sizes, have reported opposing conclusions, continuing the debate on the impact of periodontal disease on health in pregnancy<sup>1-5,7,8</sup>. However, different parameters based on clinical attachment loss (CAL), periodontal pocket depth (PPD), bleeding on probing (BoP), and plaque index (PI) induce a great range of prevalences of periodontal disease, making it more difficult to identify an actual association<sup>9</sup>.

A classification system proposed by the American Academy of Periodontology in 1999 provided a framework to organize the broad spectrum of periodontal diseases, including a section on gingival diseases,

which mentioned pregnancy as a modifying systemic factor<sup>10</sup>. The classification was reviewed in 2017 and defined bleeding on probing as a primary parameter for gingivitis and added forms of periodontitis and how to stage and grade the disease<sup>11</sup>.

Escobar-Arregoces et al.<sup>12</sup> analyzed the systemic inflammatory response in patients at a high risk for premature delivery (n = 23) and its relationship with periodontal disease. Compared with a control group (n = 23), higher levels of proinflammatory interleukins and tumor necrosis factor alpha and gamma were found in patients with chronic periodontitis compared to patients with gingivitis or periodontal health. These cytokines, in particular interleukin 2 and 10 and tumor necrosis factor alpha, were higher in patients at a high risk for premature delivery.

To estimate the possible relationship between periodontal pathogens and PTB and / or LBW, Calixto et al.<sup>13</sup> collected subgingival biofilm samples from the four deepest sites up to 48 hours postpartum and performed a polymerase chain reaction to check for the presence of *Prevotella intermedia*, *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Treponema denticola*, *Tannerella forsythia*, and

*Aggregatibacter actinomycetemcomitans*. There were no significant associations between PTB and LBW with the majority of the periodontal pathogens, even in the clinical presence of periodontitis. On the other hand, the high presence of periodontal pathogens in the subgingival biofilm of puerperal women indicates that further studies are needed on the pathophysiology involved in the relationship between periodontitis and PTB and/or LBW.

Taniguchi-Tabata et al.<sup>14</sup> investigated the association between intrauterine fetal growth patterns and periodontal status in 53 pregnant women, whose periodontitis was diagnosed based on Probing depth (PD) and CAL. The levels of maternal urinary 8-hydroxy-2'-deoxyguanosine and the body mass index were recorded. Ultrasound measurements of biparietal diameter, waist circumference, and length of the femur were recorded and the estimated fetal weight was calculated, as well as approximation spline curves throughout the gestation period. The results recorded for delivery were gestational age, birth weight and length, sex, placental weight, and umbilical cord length. The final sample consisted of 44 participants ( $34.1 \pm 4.9$  years). The average neonatal weight at birth was  $2906.0 \pm 544.4$ g. In the multiple regression analysis, birth weight was related to periodontitis (standardized  $\beta = -0.21$ ,  $p = 0.001$ ). For the biparietal diameter and the estimated fetal weight, the curves of the group with periodontitis were smaller, with significant differences after 32 weeks and 20 weeks, respectively.

Ye et al.<sup>15</sup> determined the amount of bacteria in saliva, subgingival plaque, and placenta in women at risk for PTB and/or LBW, in order to identify periodontal pathogens specific to the risk of pregnancy complications. Polymerase chain reaction with TaqMan probe and immunoassay test were used to detect the amount of *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola*, *Fusobacterium nucleatum*, and *Prevotella*

*intermedia*, in addition to IgG titrations against 28 bacteria in 36 healthy pregnant women. There were 13 newborns with LBW, in which six periodontal disease bacteria were detected in the placenta samples. The amount of *Fusobacterium nucleatum* and the frequency of detection of *Treponema denticola* in placenta samples was significantly higher in the PTB group than in the healthy group. Meanwhile, age, gingival IgG in serum, amount of *Porphyromonas gingivalis* and *Tannerella forsythia* in plaque samples, frequency of detection of *Prevotella intermedia* in saliva, and percentage of  $PD \geq 5$ mm were higher in women at risk for PTB/LBW than in healthy women PTB or PT. Ordinal logistic regression analysis revealed that the presence of *Fusobacterium nucleatum* in placental tissues was significantly associated with PTB, while maternal age was significantly associated with LBW in PTB.

The purposes of the present study were to investigate the prevalence of periodontal disease in pregnant women who were admitted to a public hospital to give birth, and to evaluate a possible relation between periodontal disease and frequency of preterm birth and low birth weight.

## Materials and Methods

### Sample and type of study

This cross-sectional study was approved by the General Hospital of Grajaú Ethics Committee (approval number 69/2010) and registered in the Brazilian National Research Ethics Committee. The women were invited to take part in the study and after a short explanation of the objectives and clinical procedures, those who agreed to participate signed the written informed consent form.

### Study design

The study was conducted at the General Hospital of Grajaú, a state health facility located in the south zone of São Paulo city in São Paulo state, Brazil,

with pregnant women who were admitted for delivery. Sampling was for convenience.

Collected maternal data were age, ethnicity, marital status, occupation, household income, number of years of schooling, number of previous pregnancies, number of prenatal visits for this pregnancy, gestational age at delivery (in weeks), method of delivery, maternal health status, drugs of abuse, or other conditions. Infant data included weight and length.

The same dentist performed the full-mouth periodontal examination in all participants. Of the sample, 10% were examined twice for each of the clinical criterion evaluated, in order to obtain the intra-examiner diagnostic reliability measured by the Kappa statistic (between 0.8 and 1.0). The measurements were performed with periodontal probes and the range of values used was within the metrics used in periodontal protocols, which minimized possible errors in the evaluation of patients. CAL, PPD, and BoP were recorded on all teeth at six sites per tooth: mesiobuccal, buccal, distobuccal, mesiolingual, lingual, and distolingual, using a Marquis periodontal probe (Hu-Friedy, USA).

Mothers with a diagnosis of gingivitis received oral hygiene instructions while mothers with periodontitis were referred for periodontal treatment at the University of Santo Amaro Dental Clinic.

#### **Inclusion and Exclusion Criteria**

Inclusion criteria were age between 18 and 40 years, and in the first 48 hours after delivery; exclusion criteria included infectious, immunological, or systemic diseases that required antibiotics

for periodontal examination and patients with any syndrome.

#### **Procedures**

The following clinical parameters were used to define the periodontal status (American Academy of Periodontology)<sup>11</sup>: healthy, no gingival bleeding and PPD  $\leq$  3mm; gingivitis, BoP and PPD  $\leq$  3mm; and periodontitis, at least one site with PPD  $\geq$  3mm. Data were analyzed using the Kruskal-Wallis and chi-square tests, at the statistical significance level of  $\alpha = 0.05$ .

The parameters used for the newborn's weight followed the World Health Organization Guidelines<sup>16</sup>.

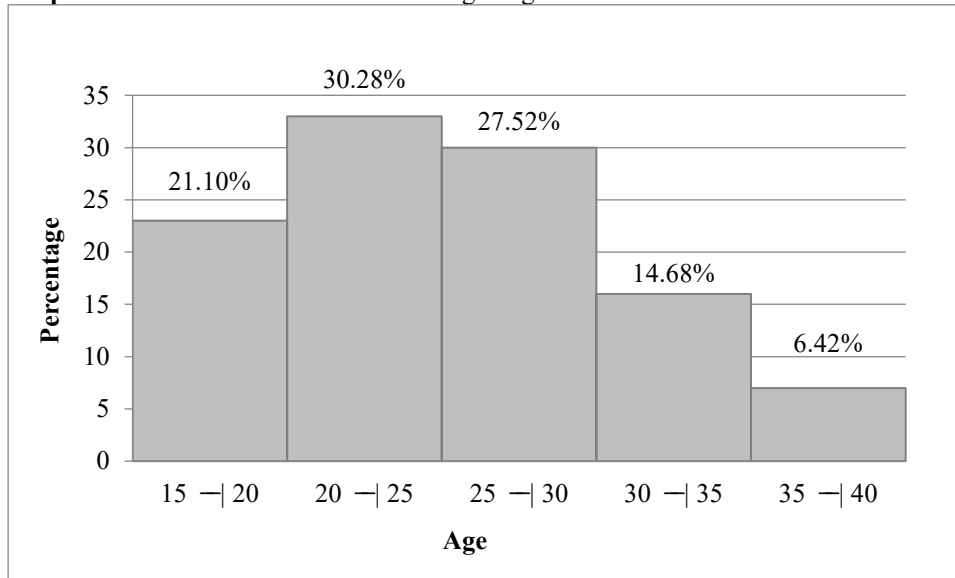
All analyses were performed using SPSS statistical software version 18.

#### **Results**

A total of 109 mother-infant pairs were examined (mean  $\pm$  standard error (se): age  $25.77 \pm 5.61$  years [range: 18-38 years]; number of prenatal visits  $6.78 \pm 2.93$  visits [range: 0-14 visits]; gestational age at delivery  $38.32 \pm 1.68$  weeks [range: 32-42 weeks]; infant weight  $3,118.66 \pm 444.17$  g [range: 2,050.00-4,000.00 g]).

Less than one-quarter (21.1%) of the mothers was older than 30 years, while a little more than half (51.38%) were younger than 25 years (Graph 1). There were eight PTB infants with LBW, six PTB infants with normal weight, and five full-term infants with LBW. The number of normal deliveries ( $n = 78$ , 71.56%) was higher than the number of cesarean deliveries ( $n = 31$ , 28.44%).

**Graph 1.** Distribution of mothers according to age



According to the clinical parameters, there were seven mothers with healthy periodontium, 50 mothers with gingivitis, and 52 mothers with

periodontitis. No significant differences were found among mother or infant variables and periodontal status (Table 1).

**Table 1.** Kruskal-Wallis test for comparisons of mother and infant variables by periodontal status

	Healthy	Gingivitis	Periodontitis	p-value
<b>Age</b>				
median	27.0	23.0	27.0	0.09
mean	26.4	24.0	27.0	
SE	7.5	4.8	5.6	
<b>Number of prenatal visits</b>				
median	6.0	7.00	7.0	0.29
mean	6.1	7.3	6.4	
SE	3.9	2.7	3.0	
<b>Gestational age</b>				
median	38.0	38.0	39.0	0.16
mean	37.4	38.1	38.6	
SE	2.1	1.6	1.6	
<b>Infant weight</b>				
median	3065.0	3170.0	3147.5	0.59
mean	2972.8	3104.9	3151.5	
SE	537.4	411.7	465.5	
<b>Infant length</b>				
median	47.0	49.0	49.0	0.53
mean	47.6	48.6	48.6	
SE	2.1	2.2	2.3	

Among the 14 preterm infants, there was one mother with healthy periodontium, eight mothers with gingivitis, and five

mothers with periodontitis. Among the 13 infants with LBW, two mothers had no signs of periodontal disease, five mothers

had gingivitis, and six mothers had periodontitis. Table 2 shows the distribution of the periodontal status of the mothers for

full-term pregnancies and normal infant weight.

Table 2. Distribution of full-term pregnancies and infants with normal weight according to the periodontal status

	Healthy	Gingivitis	Periodontitis	Total
≥ 37 weeks	6	42	47	95
≥ 2500 g	5	45	46	96

## Discussion

The present study aimed to evaluate the controversial relation between periodontal disease and PTB and/or LBW. In a population with extreme social vulnerability, a high prevalence of periodontal disease is expected, but the same cannot be said for the number of complications during pregnancy. Thus, this a priori study carried out a survey of the quantity of PTB and LBW to subsequently verify the impact of oral health and other associated factors.

In the literature, there is no consensus as to whether periodontal disease can result in adverse outcomes. The first investigations on this theme were performed in the middle of the 1990s with Offenbacher case-control studies<sup>1,2,5</sup>. Thereafter, studies with the same methodology also reinforced the association<sup>7,18-23</sup>, however, many others did not find any relation<sup>3,4,8,24-30</sup>.

The studied group belongs to a poor region in the São Paulo south zone, the richest city in Brazil. The General Hospital of Grajaú has 38 beds for pregnant women, six beds in the neonatal intensive care unit, and it is considered a referral hospital for high-risk pregnancies. In 2002, Okazaki<sup>17</sup>, in a similar study with 496 mothers, showed the mean years of schooling was 6.4 years and 63% had a household income between zero and three minimum wages. These characteristics highlight the health vulnerability of these women before pregnancy.

As expected for people who live in poor areas, the participants exhibited a high

prevalence of periodontal disease, but the same preconception idea of a greater number of adverse pregnancy outcomes was not observed. The socio-demographic characteristics of the present cohort sample were not far different from the Okazaki<sup>17</sup> findings: women aged 19 to 25 were the largest age group, gestational age greater than 37 weeks, 67.9% of mothers had between one and six prenatal visits, and 62% of the newborns weighed more than 3.000 g. Regarding the long time span, women from this area did not follow the current tendency to pregnancy later in life, perhaps due to their low labor force participation or number of years of schooling, and also the number of prenatal visits did not increase, suggesting high dependency on public health services.

Almost all the mothers had periodontal disease (95.41%), with a similar proportion of both gingivitis and periodontitis. According to the clinical parameters adopted in this study, the presence of at least one site with CAL ≥ 3mm led to a diagnosis of periodontitis, resulting in the acceptance of conditions such as gingival retractions, inactive periodontal pockets, and aggressive periodontitis as the same disease. The American Academy of Periodontology<sup>11</sup> considers PPD ≤ 3mm and BoP as gingivitis and at least one site with PPD ≥ 4mm as periodontitis, however, the extent and severity can affect a possible relation between periodontal disease and pregnancy outcomes.

Associations were found between PTB and/or LBW with several clinical criteria: at least four sites with PPD ≥ 4mm

or  $CAL \geq 3mm^7$ , at least one site with  $PPD \geq 4mm$  or one to 15 teeth with  $CAL \geq 3mm$  and  $BoP^{17}$ , at least one site with  $CAL \geq 3mm$  and  $BoP^{22}$   $CAL \geq 6mm^{23}$  at least four teeth with one or more sites with  $PPD \geq 4mm$  or  $CAL \geq 3mm$  and  $BoP$  in the same site<sup>25</sup>. In the case of changing one of these parameters, different prevalences could be obtained and the association with PTB and/or LBW may be sustained or not<sup>1,3,5-9,19-25,27,29-31</sup>. A restrictive definition of what is considered periodontal disease reduces the prevalence, but increases the specificity and probability of a correct diagnosis<sup>26</sup>.

Only 6.42% women were periodontally healthy and a considerable percentage of periodontal disease was found in mothers with full-term pregnancies or infants with normal weight<sup>1,3,8,20,28</sup>. Overall, the number of PTB and/or infants with LBW is relatively small in the literature; in the current study, there were 11.92% (n = 14) infants with LBW and 12.84% (n = 13) PTB, of which eight were PTB/LBW.

Some factors other than periodontal status, can contribute to the adverse pregnancy outcomes, among sociodemographic characteristics, a low number of years of schooling<sup>8,22,23,25</sup>, low household income<sup>26</sup>, and inadequate prenatal care<sup>22-24,28,29</sup>, or none of these<sup>1,4,7,19,20,27</sup> and some health conditions, especially diabetes and hypertension<sup>3,7,8,29,30</sup>, as well as smoking are also subject to controversies<sup>1,3,4,7,8,20,23-25,27,29,31</sup>.

Specific periodontal pathogens can explain the effect of periodontal disease on

certain systemic pro-inflammatory states<sup>2,4,6,30</sup>, as has been shown by elevated levels of inflammatory cytokines found in the plasma of pregnant women and<sup>2,33</sup>, recently, periodontal bacteria were isolated in placental tissue<sup>34</sup>.

Our study comprised a convenience sample, which might make it difficult to extrapolate the results to the general population and must be considered a limitation of this study.

This study did not find any association between periodontal status and adverse pregnancy outcomes. Further investigations are necessary with a detailed classification of periodontitis, based on severity, complexity, extent, and distribution, in order to evaluate the actual impact of the periodontal condition on pregnancy. Until then, dental screening and treatment before conception is a reasonable recommendation to prevent oral problems during pregnancy<sup>35</sup>.

## Conclusion

The evaluation of oral health carried out in the mothers in the first 48 hours after delivery showed that the majority had gingivitis or periodontitis, suggesting a high prevalence of periodontal disease. The number of preterm births and babies with low weight was considered small and no statistically significant correlations with the periodontal condition of the mothers were observed.

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