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Original Research Article

Maternal periodontitis and its influence on duration of gestation and fetal birth weight

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ABSTRACT

Background: There has been a lot of interest in knowing the effects of oral health on adverse pregnancy outcomes like preterm births and low birth weight. Studies have yielded contradicting results and there are lot of confounding issues that blur the picture. Aim of the study is to determine the prevalence of periodontitis is pregnant population and determine the effect of periodontitis on preterm births and low birth weight.
Methods: This was a cross sectional study of singleton pregnant women attending ante-natal checkups with oral interview and clinical examination. Oral examination was done at the beginning of third trimester of pregnancy. They were followed up to delivery to note the duration of gestation, birth weight of babies.
Results: The prevalence of periodontitis was 22% with 90.9% having mild and 9.1% having moderate periodontitis. Maternal education (high school and above) was associated with lower prevalence of periodontitis (p=0.042). There was no difference in the birth weights between the group with and without periodontitis (2.9±0.41kgs vs 2.74±0.36kgs, p=0.11). The incidence of low birth weights was also similar (p=0.22). The average gestational age was slightly less in the group with periodontitis (38 weeks 3 days vs 37 weeks 5 days) but the rates of preterm births were similar between the two groups (p=0.61).
Conclusions: Mild/moderate periodontitis does not appear to have a significant effect on pre-term births and low birth weight. Maternal education and awareness seem to mitigate development of periodontitis and adverse pregnancy outcomes.

Keywords: Ante-natal care, Duration of gestation, Low birth weight, Maternal education, Periodontitis, Preterm birth

INTRODUCTION

Maternal health including oral health has important implications on the outcome of pregnancy. Comprehensive prenatal health care should include oral health evaluation but is often neglected. It is estimated that 50% of pregnant women suffer from periodontitis.[1] Hormonal changes in pregnancy alters the inflammatory milieu and predispose to periodontal inflammation.

Persistent periodontal infection leads to chronic systemic inflammation that can adversely affect pregnancy Outcome-causing preterm birth, preeclampsia, gestational diabetes, small for gestation babies and fetal loss.[2-4] Three fourth of perinatal mortality is due to preterm births. Nearly 18% of preterm low birth weight deliveries are attributable to periodontitis. Inflammatory cytokines like IL1, IL6 and TNF alpha increase prostaglandin synthesis and precipitate labour.[5] Periodontitis is a risk

factor for low birth weight and pre-term births in India.[6,7] Periodontitis, especially severe, is associated with 200% increased risk of preeclampsia. However not all studies support these findings.[8,9] Benefits of treating periodontitis in pregnancy have also yielded diverse results.[10] Adverse pregnancy outcomes are multifactorial and there is significant overlap of factors which can also contribute to the development of periodontitis. This study intends to look at the prevalence of periodontitis and demographic features associated with periodontitis among rural pregnant woman attending pre-natal health checkups and possible effect of periodontitis on preterm births and birth weight.

METHODS

Study population

The subjects were enrolled by convenience sampling from the areas adopted by our medical college as a part of community out-reach program. 100 pregnant woman entering into their third trimester and attending to routine ante-natal checkup were enrolled. Women in the age group of 18–35 years, having a singleton pregnancy and having at least 20 teeth were included. The exclusion criteria were multiple pregnancies; HIV seropositivity; mothers with a systemic disease such as cardiovascular disease, hepatic insufficiency, glomerulonephritis, hyperthyroidism, or epilepsy; placental or uterine abnormalities; and mothers who received systemic antibiotics during pregnancy and had undergone periodontal therapy during pregnancy.

Data collection

The data from the expectant mothers were collected by interview and clinical examination and recorded using a standard questionnaire. The questionnaire included information regarding personal details, household information, demographic data, behavioral habits, medical history, and obstetric history. Personal details included were age, place of residence, and religion/caste. In the household information, details regarding duration of married life, consanguinity, type of housing, sanitation, water supply, and Socio Economic Status were recorded. Demographic data included were maternal schooling, maternal employment status, and family income over the last month (calculated by summing the incomes of all the members of the household). Other details that were recorded are dietary habits, brushing aids, duration of brushing, alcohol consumption, and illegal drugs and tobacco use during pregnancy. In obstetric history, the following details were recorded - the number of ante-natal consultations (ANC), last menses period. The following variables were recorded: height, weight, body mass index (kg/m^2), blood pressure, hemoglobin, and blood group. Socio-economic strata was classified based on Modified BG Prasad scale, updated for January 2017. At delivery maternal general health during pregnancy, and any morbidity during pregnancy like hypertension, anemia, diabetes, infections during pregnancy, pre-eclampsia, placental abruption, intrauterine growth retardation, vaginal bleeding, Rh factor isoimmunity, and their treatment was collected in addition to gestational age of baby, birth weight. Main pregnancy outcomes were gestational age and birth weight. Delivery before 37 weeks of gestation was defined as pre-term birth and birth weight less than 2500gms was taken as low birth weight.

Periodontal examination

An intra-oral examination was carried out by a single periodontologist and following parameters were recorded - bleeding on probing (BOP), measurement of probing depth (PD), and clinical attachment level (CAL). PD was measured from the free gingival margin to the bottom of the gingival sulcus/periodontal pocket using a periodontal probe. CAL was measured from the cement enamel junction to the base of the gingival sulcus/pocket. Distance was rounded down to the nearest whole millimeter. Two randomly chosen quadrants-one in upper and one in lower jaw were examined. Periodontitis was diagnosed according to the modified Gomes-Filho criteria.[11] (Table 1) BOP was recorded as positive if it occurs within 15 seconds of probing.

Table 1: Diagnostic criteria for periodontitis – Gomes-Filho, et al modified.

Severity level	Probing depth (PD)	Clinical attachment level
Severe periodontitis	≥2 teeth with ≥1 site with PD≥5 mm	≥5 mm on the same site
Moderate periodontitis	≥2 teeth with ≥1 site with PD≥4 mm	≥3 mm on the same site
Mild periodontitis	≥2 teeth with ≥1 site with PD≥4 mm	≥1 mm on the same site
No periodontitis	Not satisfying the above criteria	

Statistical analysis

The statistical analysis was performed using SPSS ver. 21.0 (SPSS Inc., Chicago, IL, USA). The distribution of maternal socio-demographic characteristics, medical history and clinical findings according to the presence and absence of periodontitis were compared. Continuous variables were expressed as mean with standard deviation. Categorical variables were expressed as ratios. ANOVA test was used to compare means of continuous variables. Chi square test or Fisher exact test was used to compare categorical variables. Statistical significance was considered at a 5% level.

RESULTS

A total of 100 pregnant women were included in the study. None of the participants had been exposed to oral health education or periodontal therapy before the study.

The prevalence of periodontitis was 22% in the study population. 20 (90.9%) had mild periodontitis and 2 (9.1%) had moderate periodontitis. None had severe periodontitis. 21 women had only bleeding on probing without an increase in probe depth or clinical attachment loss and were considered not to have periodontitis. The average probe depth was 3.28mm (SD±0.6) and was higher in those with periodontitis (4.27±0.63mm vs 2.87±0.34mm).

The mean clinical attachment level was 0.9mm (SD±0.85). It was 1.68mm (SD±0.84) in those with periodontitis and 0.68mm (SD±0.71) in those without periodontitis.

The mean age of the participants was 22.85 years (SD±3.43). Periodontitis prevalence increased with age with 50% prevalence in 31-35y group. All the women reported brushing teeth daily with a toothbrush. The average time spent on oral hygiene related activities was 11±12.9 min per day (13±16.2 min vs 10.4±11.9 min in those with and without periodontitis respectively, P=0.39). Both the groups had similar ante-natal care visits (6.9±2.9 vs 6.7±2.6 visits in those with and without periodontitis respectively, p=0.94). Also there was no difference between the groups with and without periodontitis with respect to weight (56.6±9.5 kg vs 58.6±10 kg, p=0.41), systolic BP (108±11.4 mmHg vs 108±11.4 mmHg, p=0.97) or diastolic BP (70±10 mmHg vs 68.3±10.5 mmHg, p=0.63), mean blood sugars (87±16.7 mg% vs 86.5±11.7 mg%, p=0.87) and hemoglobin levels (10.6±1.5 gm% and 10.7±1.6 gm% (p=0.75). (Table 2) 11, 29, 42, 16 and 2 were in low, lower middle, middle, upper middle and upper income group respectively with no difference in the prevalence of periodontitis between different socio-economic strata (p=0.53). There was no difference between the group with and without periodontitis with respect to the type of housing (p=0.5), socio-economic strata (p=0.53), source of water for consumption (p=0.35), maternal blood group (p=0.86). Hypothyroidism was the most common associated co-morbidity found in 11% of pregnant woman. All were taking adequate thyroid hormone supplements. Hypothyroidism was not associated with development of periodontitis (p=0.86). None reported using alcohol or tobacco. Only 5 had not received any formal schooling. 6, 12, 37, 40 had attended primary, mid-level, high school and college education respectively. Maternal education level seems to influence the prevalence of periodontitis. (Figure 1) Woman with less formal education tended to have more periodontitis (p=0.004). Also type of maternal employment was associated with the development of periodontitis (p=0.006).

Table 2: Characteristics of study participants.

	All	With periodontitis	No periodontitis	p value
Age (years)	22.85 (±3.4)	23.32 (±4.1)	22.72 (±3.2)	0.47
ANCs	6.7 (±2.7)	6.9 (±2.9)	6.7 (±2.6)	0.94
Weight (kgs)	58.2 (±9.9)	56.6 (±9.5)	58.6 (±10)	0.41
Time for oral hygine (mins)	11 (±12.9)	13 (±16.2)	10.4 (±11.9)	0.39
Systolic BP (mmHg)	108 (±11.3)	108 (±11.4)	108 (±11.40)	0.97
Diastolic BP (mmHg)	68.6 (10.3)	70 (±10)	68.3 (±10.5)	0.63
Hb (g%)	10.7 (±1.6)	10.6 (±1.5)	10.7 (±1.6)	0.75
RBS (mg%)	86.6 (±12.9)	87 (±16.7)	86.5 (±11.7)	0.87
Hb (at delivery)	9.8 (±1.4)	9.9 (±1.3)	9.7 (±1.4)	0.44
Hypothyroid	11	3	8	0.70
Family income (Rs/yr)	11270 (±6733)	11864 (±9843)	11103 (±5633)	0.64
Probe depth (mm)	3.28 (±0.6)	4.27 (±0.63)	2.87 (±0.34)	0.00
Clinical Attachment Level (mm)	0.9 (±0.85)	1.68 (±0.84)	0.68 (±0.71)	0.00
Maternal schooling*		9/13	14/64	0.042
*(Less than/More than High School)				

Periodontitis and birth weight/pre-term birth

The mean duration of pregnancy was 38 weeks 2 days (SD±9 days). The duration of gestation was 35 weeks 4 days (SD±4 days) in the pre-term group and 38 weeks 5 days (SD±5 days) in the term group. The average duration of pregnancy was 38 weeks 3 days (SD±9 days, 95% CI=38weeks 1 day - 38weeks 5 days) and 37 weeks 5 days (SD±8.6 days, 95% CI= 37weeks 1 day - 38weeks 2 days) in the group without and with periodontitis

respectively (p=0.024). Figure 2 shows the median and quartile distributions of duration of gestation according to periodontal status. Pre-term deliveries were 14% of the total deliveries with 11 in the group with-out periodontitis and 3 in the group with periodontitis (p=0.61) (Figure 3). The odds ratio for pre-term delivery in periodontitis group was 0.96 (95% CI 0.24-3.8, p=0.95) (Table 3).

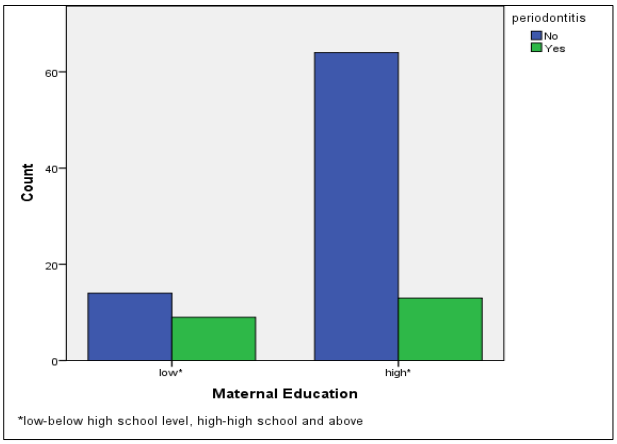

Figure 1: Distribution of subjects with periodontitis according to maternal education.

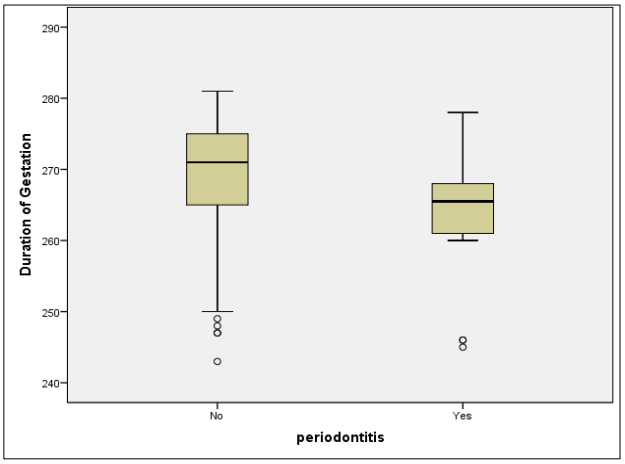

Figure 2: Distribution of 'duration of gestation' in subjects with and without periodontitis.

Table 3: Odds ratio of low birth weight/preterm birth with respect to periodontitis.

		Odds ratio	95% CI	P value
Periodontitis	Low birth weight	2.06	0.67-6.33	0.2
	Preterm birth	0.96	0.24-3.8	0.95

The mean birth weight was 2.86 kgs (SD±0.4), with pre-term births averaging 2.3 kgs (SD±0.13) and term group averaging 2.95 kgs (SD±0.35). The birth weight in periodontitis group was 2.74 kgs (±0.36, 95% CI=2.57-2.91) and in non-periodontitis group was 2.9 kgs (±0.41, 95% CI=2.81-2.99) (p=0.11).

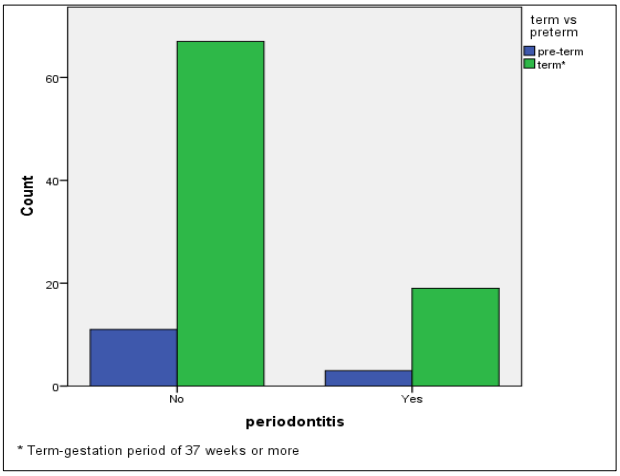

Figure 3: Distribution of term births according to periodontal status.

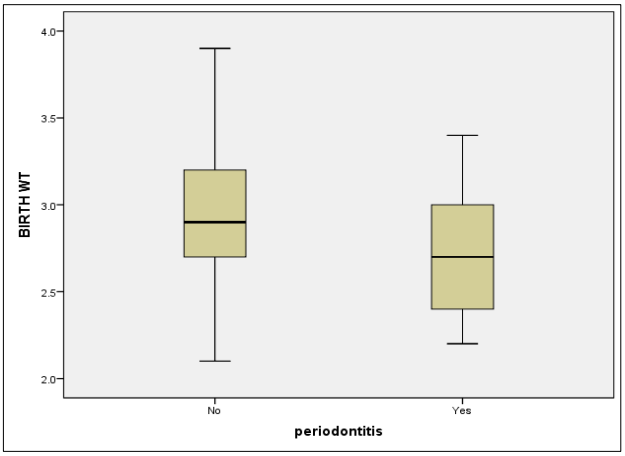

Figure 4: Distribution of birth weight in subjects with and without periodontitis.

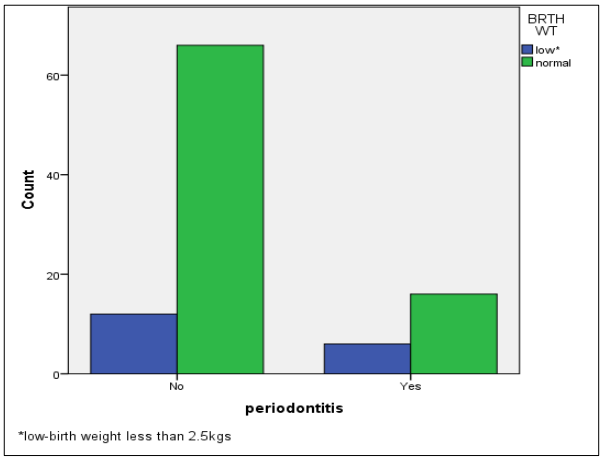

Figure 5: Distribution of low birth weight deliveries according to periodontal status.

Figure 4 shows the median and quartile distributions of birth weights according to periodontal status. There were 18 deliveries of low birth weight babies, with six occurring in the periodontitis group and 12 in the non-periodontitis group (p=0.22). (Figure 5) The odds ratio for low birth delivery in periodontitis group was 2.06 (95% CI 0.67-6.33, p=0.2) (Table 3).

There was no significant difference between any complications like anaemia, PIH, chorioamnitis or PPH between the groups. There was no significant correlation between duration of gestation and birth weight with probe depth, clinical attachment level, per-capita income, hemoglobin, blood pressure and blood sugars (Table 4).

Table 4: Correlation between duration of gestation and birth weight with various factors.

			Per-capita	RBS	Hb	BP	Probe depth	CAL
Spearmans Rho	**Duration of gestation**	Correlation coefficient	-0.010	0.097	-0.146	0.002	-0.162	-0.181
		Significance (2 tailed)	0.918	0.338	0.147	0.982	0.106	0.072
	Birth weight	Correlation coefficient	-0.056	0.041	0.048	0.020	-0.086	-0.025
		Significance (2 tailed)	0.580	0.685	0.638	0.840	0.397	0.806

DISCUSSION

There are wide discrepancies in health-related indices between urban and rural population, with rural areas having the higher burden on nutrition and infection related problems. However oral health is not received much attention. In this study we attempted to determine the prevalence of periodontitis in the pregnant woman population. Our cohort is unique in that it was from rural areas, a traditionally underserved population. In our study, the prevalence of periodontitis was 22%. The reported prevalence of periodontal disorders ranges from 10 to 78% in literature. Periodontal disorders can affect 42% of general population in rural India and 31 to 50% among pregnant population.[12] The wide variations in the reported prevalence of periodontitis are mainly due to the different diagnostic criteria employed in the studies. Studies have reported that prevalence of periodontitis increases with age which could be due to changes in host immunity and the cumulative effect of the untreated disease process over the time.[13] A relatively younger population in our study may also contribute to the lower observed prevalence of periodontitis. Findings similar to our study was reported by Piscoya et al from South America.[14] The lower prevalence of periodontitis in this study could be due to better awareness about hygiene. Maternal formal education levels and maternal employment were the only factors that were found to be significantly associated with the development of periodontitis. Pregnant woman with relatively higher levels of formal education (beyond primary schooling) had a lower prevalence of periodontitis. Though maternal employment status was also found to be associated with periodontitis, the finding could be secondary to better schooling and not income. In fact there was no difference in the prevalence of periodontitis between the different socio-economic strata. Education creates awareness and can influence the attitude and practice of people towards healthy lifestyles, nutrition and preventive aspects of health care. This is reflected by the universal adaptation of daily brushing of teeth using a tooth brush by all the subjects and higher average number of ante-natal contacts compared to the recommended minimal of 3 ANCs by government of India (but still less than 8 ANCs recommended by WHO) and lower prevalence of anaemia (64%) compared to greater than 73% reported.[15-17] An inverse relation between maternal education and periodontitis was reported from Nigerian women in university campus area.[18] However a study from Chandigarh found no significant association between maternal education level and periodontitis but women from higher socio-economic strata were less likely to have periodontitis.[19] It would be interesting to know if the maternal education would show similar influence outside of the areas adopted by our institution.

We also found no association between the types of housing, source of drinking water. Uncontrolled hypothyroidism is associated with destruction of periodontum due to higher salivary TNFα and IL6 levels.[20] Since pregnant women are routinely screened for hypothyroidism and treated if necessary, its effect may not have been evident in our study.

The mean probe depth was 2.87mm and 4.27mm in group without and with periodontitis. S Moore et al reported a much lower mean probe depths of 1.59mm and 2.78mm in pregnant women without and with periodontitis.[21]

The pre-term birth rate was 14% in the group which is comparable to the national average of 12.9% reported in the national health portal of India.[22] However this is still higher than the 7% reported in United Kingdom. Low birth weight rate was 18% in our study. Sudha G et al reported that 34% of babies born in Chittoor district of Andhra Pradesh to be of low birth weight.[23] In the present study, 34% of subjects were less than 20 years age, 44% between 21-25 year age, and 20% between 26-30 year ages. This distribution is similar that reported in study by Sudha G et al. 77% of subjects in our cohort had received education of high school or higher compared to 6.5% in study by Sudha G et al.[23] Pre-term births and low birth weight are associated with significant peri-natal morbidity and mortality. Many of the traditional risk factors for periodontitis overlap with that of pre-term births and low birth weight.

The mean probe depth was 3.29±0.63mm and 3.21±0.43mm (p=0.8) in the term and pre-term group. There appeared to be no relationship between periodontitis and pre-term births in our group. However the average gestational age was higher in the group without periodontitis. Probe depth was 3.15±0.6mm and 3.33±0.61mm in normal and low birth weight group. There appears to be no association between periodontitis and low birth weight of babies. Govindaraju P et al reported significant difference in PD between term and pre-term births (2.86±0.54 vs 5.83±0.86, p=0.001).[24] A study from Kosovo reported PD of 2.26±0.49 mm and 2.49±0.49 mm in term and pre-term deliveries. The PD was 2.27±0.50mm and 2.46±0.47mm in woman with normal and low birth weight babies (p=0.03). The birth weight was 3.2±0.68kgs and 2.75±1kgs (p=0.0003) and the gestation period 38.6±2.7 weeks and 36.4±4.8 weeks (p=0.0001) in the normal and periodontitis groups in their cohort.[25]

Limitations of our study are: This study has a power of 62% and is not adequately powered. We did not have significant numbers of higher-grade periodontitis. Selection bias cannot be ruled out due to convenience sampling method adopted. We used partial mouth recording of periodontal variables to minimize patient discomfort which can under diagnose periodontitis.

CONCLUSION

There appears to be no association between mild to moderate maternal periodontal disease and preterm birth or low birth weight birth in our cohort. Effect of severe periodontal disease on pregnancy outcomes need further evaluation.

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Conflict of interest: None declared
Ethical approval: The study was conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards

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