



Influence of Maternal Periodontal Disease as a Risk Factor for Low Birth Weight Infants in Indian Population

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ABSTRACT

Background: Low birth weight is a known problem worldwide and appears to be more pronounced in developing countries. In view of the implication of periodontal infection as one of the risk factors for low birth weight and considering the fact that in India only very few studies are conducted in this regard, the present study was conducted to determine whether maternal periodontal disease can act as a risk factor for low birth weight babies.

Materials and methods: The study group consisted of 62 primiparous mothers including 12 low birth weight cases who satisfied the inclusion/exclusion criteria. The age of the patients ranged from 18 to 37 years with a mean age of 23.27 years. Birth weight of the babies ranged from 1.64 to 3.75 kg and the mean weight was 2.67 Kg. Mean weight, height and body mass index (BMI) of the mothers were 53.47 Kg, 1.51 m, 23.48 respectively.

Results: Birth weight of the babies was regressed against age, BMI, plaque index (PI) and community periodontal index (CPI). Periodontitis was significantly associated ($p < 0.0005$) with a decrease of birth weight.

Conclusion: Periodontal disease was significantly related to preterm low birth weight.

Keywords: Low birth weight, Periodontal disease, Indian population.

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INTRODUCTION

The concept of periodontal disease influencing systemic health is not new. Epidemiological, microbiological and immunological studies have led to the concept that periodontal disease might be a separate risk factor for cardiovascular, cerebrovascular and respiratory disease, as well as preterm delivery of low birth weight infants.^{1,2}

However, recent progress in identification and characterization of periodontal pathogens, as well as elucidation of potential systemic mechanisms of action of bacterial products and inflammatory cytokines, have opened the way for a more realistic assessment of the systemic importance of periodontal disease.³

Oral health has been associated with pregnancy for generations. However, the association of oral health of the pregnant women to low birth weight (LBW) of the newborn has been the subject of investigation only recently. A study suggested that maternal periodontal disease could lead to a seven-fold increased risk of delivery of a preterm low birth weight (PLBW) infant.⁴

LBW is defined as birth weight less than 2,500 gm, which continues to be a major public health problem. LBW represents the major cause of neonatal mortality and among the survivors it is a major contributor to long-term disability including neurodevelopmental problems, respiratory problems, congenital anomalies and behavioral problems. Smoking and alcohol consumption of the mother are generally accepted as two modifiable risk factors for LBW infants. Other reported risk factors include parity, short cervical length, short maternal stature, low maternal weight, high physical and psychological stress, low educational and socioeconomic status and poor maternal nutrition.⁵

LBW is a known problem worldwide and appears to be more pronounced in developing countries. In view of the implication of periodontal infection as one of the risk factors for LBW, and considering the fact that in India only very few studies are conducted in this regard, the present study was conducted to determine whether maternal periodontal disease can act as a risk factor for LBW babies.

MATERIALS AND METHODS

The patients for this study were selected from the Department of Gynecology, MNR Medical College and

Hospital, Sangareddy, Hyderabad. Ethical clearance from the hospital authority and informed consent from the patient was taken prior to examination. Duration of the study was 4 months (September-December 2011) and the study group consisted of primiparous mothers within 3 days of postpartum. The study group consisted of 62 primiparous mothers including 12 LBW cases who satisfied the inclusion/exclusion criteria. The age of the patients ranged from 18 to 37 years with a mean age of 23.27 years. Birth weight of the babies ranged from 1.64 to 3.75 Kg and the mean weight was 2.67 Kg. Mean weight, height and BMI of the mothers were 53.47 Kg, 1.51 m, 23.48 respectively (Table 1).

Inclusion Criteria

- Study subjects were in the age group of 18 to 35 years.
- Only primiparous mothers were included in the study.
- Mothers with full-term delivery (37 weeks or more) were included in the study.

Exclusion Criteria

- Mothers with systemic diseases (diabetes, asthma, heart diseases, glomerulonephritis, hyperthyroidism) or those who had infections during pregnancy were excluded.

EXAMINATION PROCEDURE

Details regarding birth weight of the child, age of mother at delivery, educational level of the mother, onset of prenatal care, height, pregnancy and medical histories pertaining to the exclusion criteria were obtained from the hospital records. The information regarding new deliveries was collected from the department birth register. Mothers were examined within 3 days of postpartum. Information about alcohol or tobacco use, oral hygiene habits and dental treatment during current pregnancy were obtained by personal interview using a prepared questionnaire.

Periodontal status of the patient was assessed using community periodontal index (CPI). Plaque status of the mother was assessed using plaque index (Silness and Loe). Examination was done under artificial light illumination. Instruments used were mouth mirror, explorer and CPI probe. Thorough sterilization of the instruments was done by autoclave before examining the patient.

Statistical Analysis

The obtained data was coded and entered into Microsoft Excel sheet. The data was then uploaded into SPSS (statistical package for social studies) software-16 for analysis. Maternal periodontitis was then correlated with birth weight of the baby using Pearson's correlation.

RESULTS

The study included 62 primiparous mothers whose age ranged from 18 to 37 years with a mean age of 23.27 years. Birth weight of the babies ranged from 1.64 to 3.75 Kg and the mean weight was 2.67 Kg. Mean weight, height and BMI of the mothers were 53.47 Kg, 1.51 m, 23.48 respectively (Table 1).

When considering the CPI, among the mothers with LBW babies, 16.7% had CPI score 2 that indicate the presence of calculus, 33.3% had periodontal pockets of 4 to 5 mm and 50% had CPI score 4 (periodontal pocket \geq 6 mm). Among the mothers with babies of birth weight \geq 2.5 Kg, not a single patient had pocket measuring \geq 6 mm and only 9.5% of them had pocket measuring 4 to 5 mm and calculus was the highest score in 85.7% of these patients (Table 2).

When comparing the plaque status among mothers with LBW babies and normal weight babies, most of the patients in both the groups were rated plaque scores 'fair' (83.3, 90.5% respectively). Among mothers with LBW babies there was no one in plaque status grade 'excellent' and 'poor' whereas 4.8% of the mothers with normal weight babies had plaque score 'poor' (Table 3).

Correlation of plaque index and community periodontal index with LBW babies shows strong negative correlation for periodontitis and LBW (Pearson correlation = -0.606, $p = 0.001$). Correlation of plaque index with the same is not significant ($p = 0.787$) (Table 4).

Birth weight of the babies was regressed against age, BMI, plaque index (PI) and CPI; periodontitis was significantly associated ($p < 0.0005$) with a decrease of birth weight after adjusting for other factors known to affect birth weight.

DISCUSSION

LBW remains the leading cause of morbidity and mortality among neonates. PLBW infants are at higher risk for a

	Number of patients	Minimum	Maximum	Mean
Age	62	18	37	23.27
Birth weight of the baby		1.64	3.75	2.67
Weight of mother		42	62	53.47
Height of mother		1.43	1.64	1.51
BMI		18.42	25.97	23.48

number of acute and chronic disorders including respiratory distress syndrome, cerebral palsy, pathologic heart conditions, epilepsy and severe learning problems.⁶ Most of the neonatal deaths are associated with preterm delivery and birth weight under 1,500 gm. Thus, birth weight is considered to be an important determinant for infant to survive, grow and mature.

Multiple factors have been associated with the delivery of PLBW infants,⁵ of which infectious etiology plays a major role. Alternatively, it was hypothesized that PLBW may be indirectly mediated through distant infections, either by translocation of bacterial vesicles or lipopolysaccharide (LPS) in the systemic circulation. However, the exact mechanism for the proposed relationship remain unclear.⁷

Periodontal diseases are a group of infectious diseases resulting in inflammation of gingival and periodontal tissues with progressive loss of alveolar bone. The periodontal infection is initiated and sustained by several bacteria, predominantly Gram-negative, anaerobic and micro-aerophilic bacteria that colonize the subgingival area. Host defense mechanisms play an integral role in the pathogenesis of periodontal disease. It has been postulated that the association between periodontal disease and PLBW may have similar pathogenic mechanisms as other maternal infections.⁸ Inflamed periodontal tissues produce significant

amounts of proinflammatory cytokines, mainly interleukin 1 (IL-1 β), IL-6, prostaglandin E2 (BGE2) and tumor necrosis factor alpha (TNF- α), which may have effects on the host.⁹ Hence, periodontal disease has the potential to influence PLBW through an indirect mechanism involving inflammatory mediators or a direct bacterial assault on the amnion.

The association between periodontal disease and various systemic conditions is a well known fact. Among these cardiovascular disease including endocarditis and coronary heart disease, insulin-dependent diabetes mellitus and respiratory disease are much discussed. The study by Offenbacher et al 1996⁶ suggested that maternal periodontal disease could lead to a seven-fold increased risk of delivery of a PLBW infant. Collins and co-workers.¹⁰ reported that there was a 25% reduction in birth weight among pregnant hamsters, which were challenged subcutaneously in the dorsal region with the periodontal pathogen, *Porphyromonas gingivalis* when compared with normal healthy pregnant hamsters. Human case-control studies have demonstrated that women who delivered LBW infants as a consequence of either preterm labor or premature rupture of membranes tend to have more severe periodontal disease than mothers with normal birth weight infants.¹¹

Based on the evidence from the above review of information, this study was intended to determine whether maternal periodontal disease could be associated with LBW babies in the case of term deliveries.

Factors for LBW should make the conceptual distinction between intrauterine growth and gestational age duration. Hence, in this study, we have included only term LBW cases. Thus, our findings can be safely regarded as possible etiological factors for LBW independent of gestational duration.

When CPI scores were compared between mothers with LBW babies and normal birth weight babies, periodontal status of the mothers with LBW babies were comparatively very poor (Table 2). These results agree with those reported by Mokeem SA, Moll GN, Al-jewair TS.¹² They concluded that periodontal disease was more prevalent in mothers who delivered PLBW infants than in mothers who delivered full-term normal weight infants. This can be explained by the fact that periodontal disease may influence pregnancy outcome by the direct or the indirect effect of periodontal pathogens on the developing fetus.

Periodontal disease, which is a Gram-negative anaerobic infection, can affect pregnancy outcome either by the direct or indirect effect of periodontal pathogens on the developing fetus. Periodontal pathogens are thought to gain access to fetoplacental tissues via blood-borne pathways and are thought to elicit inflammatory and prostaglandin cascades

Table 2: Periodontal status of mothers with normal and low birth weight babies

CPI score	Mothers with baby weight <2.5 Kg	Mothers with baby weight \geq 2.5 Kg
0	0%	0%
1	0%	4.8%
2	16.7%	85.7%
3	33.33%	9.5%
4	50%	0%
Total	100%	100%

Table 3: Plaque status of mothers with normal and low birth weight babies

Plaque status	Mothers with baby weight <2.5 Kg	Mothers with baby weight \geq 2.5 Kg
Excellent	0%	0%
Good	16.7%	4.8%
Fair	83.3%	90.5%
Poor	0%	4.8%
Total	100%	100%

Table 4: Correlations of birth weight of the baby with plaque index and CPI of the mother

	PI	CPI
Pearson correlation	- 0.035	- 0.606
p-value	0.787	0.0005
N	62	62

that precipitate preterm low birth.¹³ While there is no evidence till date as to whether specific periodontal pathogens are found in relation to the developing fetus or the fetoplacental unit, but there is an ample evidence for the effect of other infectious agents found in the genitourinary tract on the pregnancy outcome. Bacterial vaginosis and a high prevalence of maternal lower genitourinary tract infections are associated with poor pregnancy outcomes. Colonization of the vagina and cervix with Gram-negative bacteroides is also associated with poor pregnancy outcomes. Also the possibility that inflammation of the placental membrane occur even without signs of infection, and such an inflammation is associated with poor pregnancy outcomes gives a credibility to the idea of an indirect effect of periodontal pathogens on the developing fetus.

Offenbacher et al 1996⁴ hypothesized that Gram-negative anaerobic pathogens from the periodontium with their associated endotoxins and maternal inflammatory mediators could have a possible adverse effect on the developing fetus. This view is further supported by the results obtained from animal models, where subcutaneous infection with a periodontal pathogen in pregnant hamsters resulted in decreased fetal growth as well as an increased inflammatory mediator levels.¹⁴

Periodontal infections can serve as a chronic reservoir of LPS, which could target the placental membranes via the blood stream. LPS have been shown to elicit IL-1 and PGE production by the chorioamnionic and trophoblastic cells.¹⁵ Alternately, inflammatory mediators, such as PGE2 and TNF- α may be produced locally within the periodontium and due to its potential high vascularity, act as a potential systemic source of fetotoxic cytokines. Furthermore, increased serum TNF- α level, has recently been found to be associated with the extent of disease progression in periodontitis patients who are undergoing active attachment loss.

The mother's psychological stress also acts as an indirect factor in maintaining the inflammatory state of the periodontium, which can be explained as the stressful events would stimulate pituitary-hypothalamus-adrenal axis to release cortisol hormone into circulation. This systemically released hormone enters into saliva and would cause reduction of inflammatory cells inhibiting the immune response thereby causing the inflammation of the periodontium.¹⁶

The genetic confounding factor, which may be involved in periodontal disease and LBW, cannot be ruled out. It is a fact that periodontal diseases are preventable and readily treatable. The findings from the present study and the studies previously conducted in this arena together provide new

opportunities for early intervention strategies to reduce maternal periodontal disease, which may consequently help in reducing LBW deliveries.

CONCLUSION

Poor periodontal health of the pregnant women may be a potential independent risk factor for LBW babies. The importance of this lies in the fact that poor periodontal health is a factor that is easily amenable for prevention.

Hence, the strategy should include efforts to improve health by reducing risks, promoting health and strengthening possibilities to cope with given risk factors. Antenatal care in primary health care centers should also include periodic oral checkup followed by preventive and therapeutic treatments along with effective referral system for all dental treatment needs. Advancing care in private sector for pregnant women and neonatal care has reduced the complications but the antenatal oral health care should also get sufficient attention.

REFERENCES

1. Gortmaker LS. The effects of prenatal care upon the health of the newborn. *Am J public Health* 1979;69:653-60.
2. Hujoel PP, Drangsholt M, Spiekerman C, DeRouen TA. Periodontal disease and coronary heart disease risk. *J Am Med Assoc* 2000;284:1406-10.
3. Williams CE, Davenport ES, Sterne JA, Sivapathasundaram V, Fearne JM, Curtis MA. Mechanisms of risk in preterm low-birth weight infants. *Periodontol* 2000;23:142-50.
4. Offenbacher S, Lief S, Boggess KA, et al. Maternal periodontitis and prematurity. Part 1: Obstetric outcome of prematurity and growth restriction. *Ann Periodontol* 2001;6:164-74.
5. Davenport ES, William CE, Sterene JA, et al. Maternal periodontal disease and preterm low birth weight. *J Dent Res* 2002;81(5):313-18.
6. Offenbacher S, Katz V, Fertick G, Collins J, Maynor G, McKaig R. Periodontal infection as a possible risk factor for preterm low birth weight. *J Periodontol* 1996;67:1103-13.
7. Slavkin CH. First encounters. Transmission of infectious oral diseases from mother to child. *JADA* 1997;128:773-78.
8. Lopez NJ, et al. Periodontal therapy may reduce the risk of preterm low birth weight in women with periodontal disease: A randomized controlled trial. *J Periodontol* 2002;73:911-24.
9. Lopez NJ, Smith PC, Gutierrez J. Higher risk of preterm birth and low birth weight in women with periodontal disease. *J Dent Res* 2002;81(1):58-63.
10. Collins JG, Windley HW 3rd, Arnold RR, et al. Effects of a *Porphyromonas gingivalis* infection on inflammatory mediator response and pregnancy outcome in hamsters. *Infect Immun* 1994;62(10):4356-61.
11. Arafat HA. Periodontal status during pregnancy. *J Periodontol* 1974;45:641-43.
12. Mokeem SA, Molla GN, Al-jewair TS. The prevalence and relationship between periodontal disease and preterm low birth weight infants at King Khalid University Hospital in Riyadh, Saudi Arabia. *J Contemp Dent Pract* 2004;5(2):40-56.

13. Kothiwale SV, Desai BR, Mallapur MD. Poor periodontal health as a risk indicator for low birth weight of the infants. *Indian J Stomatol* 2011;2(3):153-58.
14. Dasayanke AP. Poor periodontal health of the pregnant woman as a risk factor for low birth weight. *Ann Periodontol* 1998;3(1):206-12.
15. Jeffcoat MK, Geurs NC, Reddy MS, Cliver SP, Goldenberg RL, Hauth JC. Periodontal infection and preterm birth results of a prospective study. *J Am Dent Assoc* 2001;132:875-80.
16. Mannem S, Chava VK. The relationship between maternal periodontitis and preterm low birth weight: A case-control study. *Contemp Clin Dent* 2011 Apr;2(2):88-93.

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