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Influence of maternal periodontal health as a risk factor for low-birth-weight infants in Terai population of Nepal

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Abstract:

BACKGROUND: Preterm low birth weight (PLBW) is a leading perinatal problem in developing countries. PLBW is considered as a leading cause of neonatal death in the 1st year of life, with problems in childhood and adulthood. Several studies have suggested a possible relationship between PLBW and periodontal status of the expectant mothers. The present study was conducted to determine the association between the maternal periodontitis and the low birth weight (BW) of the babies.

MATERIALS AND METHODS: This study consisted of 200 primipara mothers ranging between 18 and 35 years old, with a mean age of 23.96 years. The mothers were categorized based on the weight of the infants as cases (BW <2500 g) and as controls (BW ≥2500 g). Age, mean weight, height, body mass index, and periodontal status of the mothers as well as weight of the babies were recorded. Periodontal parameters were assessed using the community periodontal index (CPI). The data were recorded, analyzed, and statistically compared using the Chi-square test (χ^2).

RESULTS: BW of the babies was regressed against CPI. Periodontitis was significantly associated with decrease in BW of the babies ($P < 0.0001$).

CONCLUSION: Our findings showed an association of maternal periodontal disease with PLBW that emphasizes to promote good oral hygiene of the expectant mothers during routine prenatal visits.

Keywords:

Low birth weight, periodontitis, pregnancy, Terai population

Introduction

Preterm low birth weight (PLBW) is the prime reason for perinatal mortality and morbidity and assorted neurological deficits.^[1] Oral health and its implications with pregnancy have been a debate for generations. Nevertheless, the correlation between periodontal health status of the mothers and low birth weight (BW) of the infants has been the topic of investigations only recently. Offenbacher in 1996 has mentioned the possible role of periodontal infection of the mothers in PLBW events.^[2]

Periodontal disease is one of the most common chronic infectious disorders in humans with the prevalence ranging from 10% to 90%.^[3] PLBW in infants is a major medical, social, and economic burden accounting for a large number of maternal and neonatal mortality and morbidity. The prevalence of preterm birth has shown to rise exponentially from 4.2% in 1980 to 9.5% in 2012 which clearly indicates that the problem has risen in the recent years.^[4]

The risk factors for PLBW in infants are deleterious habits such as consumption of tobacco, low maternal age, first delivery,

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history of PLBW, and abortion. Offenbacher *et al.* hypothesized that Gram-negative anaerobic periodontal pathogens and their associated endotoxins together with maternal inflammatory mediators could have a possible adverse effect on the developing fetus.^[5] Experiments carried out by Kunnen *et al.* in the pregnant rat model showed that periodontitis can affect fetal growth.^[6] Later, human studies performed by Offenbacher *et al.* and Kothiwale and Panwar showed that women who have low birth weight (LBW) infants as a result of premature rupture of placental membranes tend to have more severe periodontal disease than mothers with normal weight infants.^[5,7]

Since BW is easier to ascertain than gestational age, especially in the developing countries such as Nepal, where no ultrasound scan is carried out in early pregnancy, the BW of the infants should be used to define preterm birth rather than gestational age.

In view of the implication of periodontal infection as one of the risk factors for LBW, the present study was conducted to determine the possible relation of maternal periodontal health as a risk factor for LBW babies.

Aims and objectives

The study was conducted to assess the prevalence of periodontal diseases among the primiparous mothers delivering in the free labor ward of Narayani Sub-Regional Hospital, Birgunj, Nepal, during the study period and to estimate the association between the periodontal status of the mother and the LBW of the babies.

Materials and Methods

The patients for this study were selected from the Gynecology Ward of Narayani Sub-Regional Hospital, Birgunj, Nepal. Ethical clearance from the institution and hospital authority and informed consent from the patients were obtained prior to examination. The study group consisted of 200 primipara mothers including 68 LBW cases who satisfied the inclusion and the exclusion criteria. Information regarding the age of the mothers; Hb gram%, height, and weight of the mothers; and medical history, obstetric history, gestational age, sex, and weight of the infants was collected from the inpatient record register of the labor ward of the gynecological department. The level of education, habits, socioeconomic status, antenatal care, and history of dental treatment during current pregnancy was obtained by a self-structured questionnaire pro forma [Annexure 1].

Oral examinations of the mothers were performed using the WHO criteria. The periodontal status of the

mothers was recorded using the community periodontal index (CPI).

The analysis of healthy sextants and bleeding sextants and sextants with calculus, shallow, or deep pockets was counted for each subject. The examination was done on five index teeth, and the highest score was recorded for the patients.

Only the primipara mothers within the age of 18–35 years with full-term delivery (37 weeks of gestation or more) were included in the study.

Mothers below 18 years or above 35 years of age; those with systemic diseases such as hypertension, diabetes mellitus, asthma, heart disease, glomerulonephritis, and hypothyroidism; or those who had infections during pregnancy were excluded from the study.

Administered structured questionnaire

A self-made structured questionnaire was framed to record the required details to ascertain the risk factors for periodontal disease and PLBW. The data were collected as a hard copy on the questionnaire sheets [Annexure 1].

Community periodontal index

Periodontal status of the patients was assessed using CPI.^[8] Examination was done under artificial light illumination. Instruments used were mouth mirror, explorer, and CPI probe which were thoroughly sterilized before examination of the mothers in the labor ward.

The CPI codes used were as follows:

- 0: Healthy
- 1: Bleeding seen directly or after probing
- 2: Calculus detected during probing
- 3: Pocket depth 4–5 mm
- 4: Pocket depth 6 mm or more
- X: Exclude sextant (<2 teeth present)
- 9: Not recorded.

Data collection and analysis

The obtained data were compiled, and maternal periodontitis was then correlated with BW of the infants using Chi-square test using the Statistical Package of the Social Sciences (SPSS) software version 16.

Results

The study included 200 primipara mothers whose age ranged from 18 to 35 years, with a range of 23.96 ± 4.094 years. BW of the babies ranged from 1000 g to 4000 g, with a mean weight of 2703 ± 587.52 g. The mean values of weight, height, and body mass index of the mothers were 50.68 ± 3.651 kg, 1.58 ± 0.050 m, and 20.12 ± 1.711 , respectively [Table 1].

Table 1: Descriptive statistics

Personal details of the mother and babies	Number of patients	Minimum	Maximum	Mean±SD
Age of the mothers (years)	200	18	35	23.96±4.094
Birth weight of the babies (g)	200	1000	4000	2703±587.52
Weight of the mothers (kg)	200	40	70	50.68±3.651
Height of the mothers (m)	200	1.33	1.87	1.58±0.050
BMI	200	15.7	30.1	20.12±1.711

BMI=Body mass index, SD=Standard deviation

When considering the CPI among the mothers with LBW babies, 17.65% had CPI score of 2 that indicated the presence of calculus, 36.76% had CPI score of 3 indicating periodontal pocket of 4–5 mm, and 45.59% had CPI score of 4 indicating the periodontal depth of ≥ 6 mm [Table 2].

Among the mothers with babies of BW ≥ 2.5 kg, just 1.52% had CPI score of 4 with pockets measuring ≥ 6 mm, 10.60% had CPI score of 3 with periodontal pockets measuring 4–5 mm, 79.54% had CPI score of 2 indicating the presence of calculus, and 08.34% of the patients had CPI score of 1 indicating the presence of bleeding on probing [Table 2].

Correlation of CPI with LBW babies was found to be significant using the Chi-square test.

BW of the babies was regressed against CPI, indicating that periodontitis was significantly associated with a decrease in BW after excluding other factors known to affect BW ($P < 0.0001$).

Discussion

LBW remains the leading cause of morbidity and mortality among the children younger than 5 years of age.^[9] PLBW infants are at higher risk for a number of acute and chronic disorders including respiratory distress syndrome, cerebral palsy, pathologic heart conditions, epilepsy, and severe learning problems.^[2] Surviving late, preterm children tend to have more long-term cognitive, behavioral, and psychiatric problems than the children born at term.^[10] Most of the neonatal deaths are associated with preterm delivery and BW < 1500 g. Most studies have agreed on the preterm labor as when the baby is delivered before the 37th gestational week and a LBW when the newborn is < 2500 g.^[7,11-16] Thus, BW is considered to be an important determinant for infants to survive, grow, and mature.

Offenbacher *et al.* in the year 1996 have published that the odds ratio for periodontal disease and premature birth was significant, with a risk for PLBW 7.5-fold greater if the mothers had evidence of periodontal disease as compared to the mothers without evidence of periodontal disease.^[2] Many studies since then have been published that support the evidence that women

with periodontal disease have a greater risk for having preterm or LBW babies.^[17-21]

Multiple factors have been associated with the delivery of PLBW infants that include behavioral and psychosocial factors, neighborhood and environmental exposures, medical conditions, and genetic and biological factors.^[22] Seventy percent of preterm low births are caused by spontaneous preterm labor, preterm premature rupture of the membranes (PPROM), labor induction, or cesarean delivery for maternal or fetal indications.^[23,24]

Periodontitis results in the inflammation of gingival and periodontal tissues with progressive loss of the alveolar bone. Host defense mechanisms play an integral role in the pathogenesis of periodontal disease. It has been postulated that the inflamed periodontal tissues produce significant amounts of pro-inflammatory cytokines, namely interleukin-1 (IL-1), IL-6, prostaglandin E2, and tumor necrosis factor-alpha that may act as a potential systemic source of fetotoxic cytokines and trigger both spontaneous labor and PPROM.^[23,25]

Periodontal pathogens are thought to gain access to the fetoplacental tissues through blood-borne pathways and are thought to provoke inflammatory and prostaglandin cascades that may precipitate PLBW. Periodontal infections can serve as a chronic reservoir of lipopolysaccharide. The periodontal bacteria can infiltrate the periodontal pockets, allowing easier diffusion into the bloodstream.^[26] These bacteria then reach the amniotic fluid causing local infections that can trigger preterm birth.^[22]

Hence, periodontitis may influence PLBW through an indirect mechanism involving the pro-inflammatory cytokines or by the direct assault of the bacteria on the amnion.

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 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 safely be regarded as a possible etiological factor for LBW babies independent of gestational age.

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

CPI score	Mothers with baby weight <2.5 kg, n (%)	Mothers with baby weight ≥2.5 kg, n (%)
0	0 (0.00)	0 (0.00)
1	0 (0.00)	11 (8.34)
2	12 (17.65)	105 (79.54)
3	25 (36.76)	14 (10.60)
4	31 (45.59)	2 (1.52)
Total	68 (100.00)	132 (100.00)
χ^2 , P	103.6, <0.0001 (Significant)	

CPI=Community periodontal index

When CPI scores were compared between the mothers with LBW babies and normal BW babies, the periodontal status of the mothers with LBW babies was comparatively very poor [Table 2]. These results were same as reported by Walia and Saini, Perunovic *et al.*, and Tellapragada *et al.* who have concluded that the women with preterm birth compared to the women with term birth have poor periodontal status.^[26-28] This can be explained by the fact that periodontal disease may influence pregnancy outcome by the direct or indirect effect of periodontal pathogens on the developing fetus.

The findings from this study and other studies in this context stress the need for the early intervention to reduce the maternal periodontal disease which definitely will help in reducing the LBW deliveries. A pregnant mother needs to be thoroughly evaluated for her periodontal health during the entire term and the PLBW babies born also need to be followed to evaluate the effect of LBW on them. These findings of the present study can be a guiding force for the gynecologists to consider oral health of the expectant mother also during antenatal checkups.

Conclusion

Poor periodontal health of the expectant mothers is a potential independent risk factor for LBW of the delivered babies. Hence, during antenatal checkups, stress should be made on the maintenance of oral health and treatment of periodontal diseases that may improve the quality of life and play a significant role for the reduction of LBW babies. Therefore, medical and dental professionals should work as a team and include periodontal health care as a part of antenatal care.

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Conflicts of interest

There are no conflicts of interest.

References

1. Jeffcoat MK, Hauth JC, Geurs NC, Reddy MS, Cliver SP, Hodgkins PM, *et al.* Periodontal disease and preterm birth: Results of a pilot intervention study. *J Periodontol* 2003;74:1214-8.
2. Offenbacher S, Katz V, Fertik G, Collins J, Boyd D, Maynor G, *et al.* Periodontal infection as a possible risk factor for preterm low birth weight. *J Periodontol* 1996;67:1103-13.
3. Jiang H, Su Y, Xiong X, Harville E, Wu H, Jiang Z, *et al.* Prevalence and risk factors of periodontal disease among pre-conception Chinese women. *Reprod Health* 2016;13:141.
4. Islam MM. Increasing incidence of infants with low birth weight in Oman. *Sultan Qaboos Univ Med J* 2015;15:e177-83.
5. Offenbacher S, Jared HL, O'Reilly PG, Wells SR, Salvi GE, Lawrence HP, *et al.* Potential pathogenic mechanisms of periodontitis associated pregnancy complications. *Ann Periodontol* 1998;3:233-50.
6. Kunnen A, van Pampus MG, Aarnoudse JG, van der Schans CP, Abbas F, Faas MM. The effect of *Porphyromonas gingivalis* lipopolysaccharide on pregnancy in the rat. *Oral Dis* 2014;20:591-601.
7. Kothiwale S, Panwar V. Poor periodontal health of pregnant women as a risk factor for preterm and low birth weight. *Indian J Dent* 2011;2:129-33.
8. Peter S. *Essentials of Preventive and Community Dentistry*. 4th edition. New Delhi: Arya (Medi) Publishing House; 2006.
9. World Health Organization. Preterm Birth. Available from: <http://www.who.int/mediacentre/factsheets/fs363/en/>. [Last accessed on 2015 Oct 06].
10. Cheong JL, Doyle LW. Increasing rates of prematurity and epidemiology of late preterm birth. *J Paediatr Child Health* 2012;48:784-8.
11. Lunardelli AN, Peres MA. Is there an association between periodontal disease, prematurity and low birth weight? A population-based study. *J Clin Periodontol* 2005;32:938-46.
12. Marin C, Segura-Egea JJ, Martínez-Sahuquillo A, Bullón P. Correlation between infant birth weight and mother's periodontal status. *J Clin Periodontol* 2005;32:299-304.
13. Sánchez AR, Bagniewski S, Weaver AL, Vallejos N. Correlations between maternal periodontal conditions and preterm low birth weight infants. *J Int Acad Periodontol* 2007;9:34-41.
14. Moliterno LF, Monteiro B, Figueredo CM, Fischer RG. Association between periodontitis and low birth weight: A case-control study. *J Clin Periodontol* 2005;32:886-90.
15. Bosnjak A, Relja T, Vucićević-Boras V, Plasaj H, Plancak D. Pre-term delivery and periodontal disease: A case-control study from Croatia. *J Clin Periodontol* 2006;33:710-6.
16. Zadeh-Modarres S, Amooian B, Bayat-Movahed S, Mohamadi M. Periodontal health in mothers of preterm and term infants. *Taiwan J Obstet Gynecol* 2007;46:157-61.
17. Chakki BA, Ealla KR, Hunsingi P, Kumar A, Manidanappanavar P. Influence of maternal periodontal disease as a risk factor for low birth weight infants in Indian population. *J Contemp Dent Pract* 2012;13:676-80.
18. Khader Y, Al-shishani L, Obeidat B, Khassawneh M, Burgan S, Amarin ZO, *et al.* Maternal periodontal status and preterm low birth weight delivery: A case-control study. *Arch Gynecol Obstet* 2009;279:165-9.
19. Shanthy V, Vanka A, Bhambal A, Saxena V, Saxena S, Kumar SS.

- Association of pregnant women periodontal status to preterm and low-birth weight babies: A systematic and evidence-based review. *Dent Res J (Isfahan)* 2012;9:368-80.
20. Vergnes JN, Sixou M. Preterm low birth weight and maternal periodontal status: A meta-analysis. *Am J Obstet Gynecol* 2007;196:135.e1-7.
 21. Baskaradoss JK, Geevarghese A, Kutty VR. Maternal periodontal status and preterm delivery: A hospital based case-control study. *J Periodontal Res* 2011;46:542-9.
 22. Behrman RE, Butler AS. *Preterm Birth: Causes, Consequences, and Prevention*. Washington, DC: National Academies Press; 2007.
 23. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *Lancet* 2008;371:75-84.
 24. Romero R, Dey SK, Fisher SJ. Preterm labor: One syndrome, many causes. *Science* 2014;345:760-5.
 25. Vinturache AE, Gyamfi-Bannerman C, Hwang J, Mysorekar IU, Jacobsson B; Preterm Birth International Collaborative (PREBIC). Maternal microbiome – A pathway to preterm birth. *Semin Fetal Neonatal Med* 2016;21:94-9.
 26. Walia M, Saini N. Relationship between periodontal diseases and preterm birth: Recent epidemiological and biological data. *Int J Appl Basic Med Res* 2015;5:2-6.
 27. Perunovic ND, Rakic MM, Nikolic LI, Jankovic SM, Aleksic ZM, Plecas DV, *et al.* The association between periodontal inflammation and labor triggers (Elevated cytokine levels) in preterm birth: A cross-sectional study. *J Periodontol* 2016;87:248-56.
 28. Tellapragada C, Eshwara VK, Bhat P, Acharya S, Kamath A, Bhat S, *et al.* Risk factors for preterm birth and low birth weight among pregnant Indian women: A hospital-based prospective study. *J Prev Med Public Health* 2016;49:165-75.

Annexure 1: PROFORMA

Name: ----- Age: ----- Yrs.

Hosp. Indoor No: -----

Address: -----

Physical status:

Height: ----- cm, Weight: ----- Kg, BMI: -----

Hb%: -----

Medical history pertaining to exclusion criteria:

Obstetric history:

No. of previous deliveries: -----

No. of previous PLBW: -----

No. of previous pregnancies aborted: -----

No. of spontaneous abortions: -----

Antenatal care: Yes/No

Dental treatment during current pregnancy: Yes/No

Oral hygiene care: -----

Habits:

Tobacco: Yes/No, Quantity: -----, Duration: -----

Alcohol: Yes/No, Quantity: -----, Duration: -----

Drug abuse: Yes/No

Stress:

Demographic status:

Education: ----- Socioeconomic status: -----

Gender of the infant: -----

Gestational age: ----- weeks.

Weight of the infant: ----- grams

CPI of the mother: -----