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Original Research Article

Prevalence of bacterial vaginosis in antenatal women and its correlation with maternal outcomes: a tertiary hospital based prospective study

Aditi Singh[1]*, Nishi Makhija[1], Reema Jain[1], Juhi Srivastava[1], Yukti Sharma[2]

[1]Department of Obstetrics and Gynecology, Tirath Ram Shah Hospital, New Delhi, India
[2]Department of Microbiology, Tirath Ram Shah Hospital, New Delhi, India

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***Correspondence:**
Dr. Aditi Singh,
E-mail: 10singh.aditi@gmail.com

ABSTRACT

Background: Bacterial vaginosis (BV) is the most common vaginal infection in reproductive-aged women, with heightened risks during pregnancy, including preterm labor and low birth weight. Despite its association with poor outcomes, routine screening in pregnancy is not universally implemented, particularly in India, where regional data on BV and pregnancy outcomes are limited. Present study aimed to evaluate the prevalence of BV in antenatal women and assess its impact on maternal outcomes.
Methods: This prospective cohort study was conducted at Tirath Ram Shah Trust Hospital, Delhi, over one year (April 2025 to March 2026). Two hundred pregnant women (singleton pregnancies, <20 weeks gestation) were enrolled. BV was diagnosed using Nugent's criteria via Gram-stained vaginal smears. Maternal outcomes (abortions, preterm labor, PROM, IUD, chorioamnionitis) were tracked until delivery.
Results: Of the 200 women, 18% were BV-positive. No significant association was found between age, gravida, or mode of delivery and BV. However, BV was significantly linked with PROM (11.1% versus 0.6%) and PPROM (19.4% versus 2.4%). Preterm birth was also higher in BV-positive women (22.2% versus 2.4%).
Conclusions: BV in pregnancy was associated with higher risks of PROM, PPROM, and preterm birth. These findings suggest that routine screening and management of BV in antenatal care could help mitigate adverse maternal and neonatal outcomes.

Keywords: Pregnancy, Bacterial vaginosis, Preterm birth, Maternal outcomes, PROM, Nugent score

INTRODUCTION

Bacterial vaginosis (BV) is the most common vaginal infection affecting women of reproductive age, including pregnant women. It is characterized by an imbalance in the normal vaginal microbiota, where the predominant lactobacillus species are replaced by anaerobic bacteria such as *Gardnerella vaginalis*, *Mycoplasma hominis*, *Mobiluncus* species, and *Prevotella* species.[1] It is a significant concern during pregnancy due to its association with adverse maternal and fetal outcomes. The prevalence of BV among pregnant women varies widely across different regions and populations. Globally, studies have reported prevalence rates ranging from 10% to 40%, depending on the geographical region, diagnostic criteria, and population characteristics.[1] In India, the prevalence of BV in pregnancy has been estimated between 15% to 30%, highlighting its common occurrence in antenatal care settings.[2,3]

The exact mechanism through which BV causes adverse pregnancy outcomes remains unclear. However, it is hypothesized that the overgrowth of anaerobic bacteria leads to increased production of inflammatory mediators such as prostaglandins, cytokines, and metalloproteinases, which may weaken fetal membranes and trigger preterm labor.[4] The asymptomatic nature of BV in many women makes it particularly concerning, as undiagnosed and untreated cases can lead to complications such as late miscarriages, preterm labor, preterm premature rupture of

membranes (PPROM), chorioamnionitis, low birth weight (LBW) and neonatal infections.[5]

Despite the known association between bacterial vaginosis and adverse pregnancy outcomes, routine screening for BV in pregnancy is not universally implemented, particularly in resource-limited settings. Many antenatal women may remain undiagnosed and untreated, thereby increasing their risk of preterm birth and neonatal morbidity. Additionally, there is a lack of region-specific data on the prevalence of BV and its correlation with maternal outcomes in India.

This study aims assess the prevalence of bacterial vaginosis and its association with adverse maternal outcomes. The findings of this study will contribute to a better understanding of whether routine screening and treatment for BV in pregnancy should be recommended as part of antenatal care protocols.

METHODS

This is a prospective cohort study done in Department of Obstetrics and Gynaecology at Tirath Ram Shah Trust Hospital, Delhi. The duration of study was 01 year (April 2025 to March 2026).

We enrolled 200 pregnant women with singleton pregnancies during their routine antenatal visits (pregnancy <20 weeks) and followed them until delivery.

The sample size calculation on assumptions from Abhilasha Gupta et al which reported a preterm delivery incidence of 23.5% among BV-positive women and 2% among BV-negative women.[6] To account for potential dropouts and variability, we target a screening sample size of approximately 200 women.

Pregnant women with a singleton pregnancy at less than 20 weeks of gestation who were willing to participate and provided written informed consent were included in the study. Women with known genital infections, those who had received antibiotic therapy within the preceding two weeks, those with pre-existing pregnancy complications such as preeclampsia, placenta previa, or gestational diabetes mellitus, and those with a history of preterm birth or miscarriage in previous pregnancies were excluded from the study.

At enrolment, detailed history and informed consent was taken from each participant. A general examination followed by vaginal examination was done. A high vaginal swab was collected to diagnose BV using Nugent's criteria gram stain method. Based on the test results, women were classified into BV-positive and BV-negative groups. Then recorded and compared the maternal outcomes till delivery. Maternal outcome was assessed in terms of abortions, pre-term labor (delivery before 37 completed weeks), PROM, intrauterine death and chorioamnionitis.

Diagnosis of bacterial vaginosis

Diagnosis was made using Nugent's score (gram-stained vaginal smear). Gram staining was done by using four reagents: a basic pararosaniline dye, an aqueous solution of iodine, a decolourising solvent, and a light red or pink counterstain. Nugent's score (gram-stained vaginal smear): score 0-3: normal vaginal flora, score 4-6: intermediate, and score 7-10: bacterial vaginosis.

Score	*Lactobacilli* morphoty-pe per field	*Gardnerella* morphotype per field	Curved bacteria (mobiluncus)
0	>30	0	0
1	5-30	<1	1-5
2	1-4	1-4	>5
3	<1	5-30	5-30
4	0	>30	>30

Statistical analysis

BV was calculated by dividing the number of BV-positive cases by the total number of women screened. Maternal outcomes were compared between the BV-positive and BV-negative groups. Categorical variables, including the incidence of preterm labor, were compared using the Chi-square test. Logistic regression analysis was performed to adjust for potential confounding variables such as maternal age, parity, and socioeconomic status, and to estimate odds ratios (ORs) with 95% confidence intervals for the association between BV and adverse maternal outcomes. All statistical analyses were two-tailed, and a p value of <0.05 was considered statistically significant.

RESULTS

Present study included total of 200 participants, with majority in age group of 26-30 years (45%), 31-35 years in 26%, 20-25 years in 20.5% and >35% in 8.5%. Among the 200 participants, 82% (n=164) had a negative Nugent score, while 18% (n=36) tested positive, suggesting that a significant number of women had BV.

The age-wise distribution of Nugent scores shows that bacterial vaginosis (positive Nugent score) was slightly higher among women aged 26-30 years (36.1%) compared to other age groups. The distribution of Nugent scores across socio-economic status (SES) shows that bacterial vaginosis (positive Nugent score) was most prevalent in the lower-middle socio-economic status group (61.1%) compared to upper-lower (11.1%) and upper-middle (27.8%) groups. The distribution of Nugent scores by gravida shows that bacterial vaginosis (positive Nugent score) was slightly higher in primigravida women (61.1%) compared to multigravida (38.9%), but the difference was not statistically significant (χ^2=3.77, p=0.52), indicating no clear association between gravida status and Nugent score in this study.

There is a statistically significant association between symptoms and Nugent positivity ($p<0.05$). The analysis of PROM shows that PROM was more common among women with a positive Nugent score (11.1%) compared to those with a negative score (0.6%). The analysis of PPROM shows that PPROM occurred more frequently in women with a positive Nugent score (19.4%) compared to those with a negative score (2.4%). Post-partum endometritis was rare in the study population. Among Nugent-negative patients, none developed post-partum endometritis (0%). In the Nugent-positive group, only 1 patient (2.8%) developed post-partum endometritis while 35 patients (97.2%) did not, indicating a very low occurrence of the condition overall.

The data shows that women with a positive Nugent score had a higher proportion of preterm deliveries (22.2%) compared to those with a negative score (2.4%). This difference was statistically significant ($\chi^2=20.485$, $p=0.01$), indicating a strong association between bacterial vaginosis and preterm birth. The analysis shows that the mode of delivery (LSCS versus NVD) was similar between women with negative and positive Nugent scores, with 62.2% versus 61.1% undergoing LSCS and 37.8% versus 38.9% having NVD, respectively.

The data indicates a significant association between Nugent score and birth weight. Low birth weight (2000-2500 g) was more common in the Nugent-positive group (25.0%) compared to the Nugent-negative group (8.5%). Most babies in both groups had birth weights between 2500-3000 g. Higher birth weights (>3500 g) were predominantly seen in the Nugent negative group.

Table 1: Comparison of maternal characteristics between Nugent-positive and Nugent-negative groups.

Variables	Category	Nugent				Chi-square (p value)
		Negative		Positive		
		No. of patients	%	No. of patients	%	
Age group (years)	20-25	31	18.9	10	27.8	1.96 (0.58)
	26-30	77	47.0	13	36.1	
	31-35	42	25.6	10	27.8	
	>35	14	8.5	3	8.3	
Socioeconomic status	Lower middle	61	37.2	22	61.1	11.85 (0.03)*
	Upper lower	7	4.3	4	11.1	
	Upper middle	96	58.5	10	27.8	
Gravida	Primi	71	43.3	22	61.1	3.77 (0.052)
	Multi	93	56.7	14	38.9	

*P value statistically significant

Table 2: Association between bacterial vaginosis (Nugent score) and clinical symptoms and adverse pregnancy outcomes.

Variables	Category	Nugent				Chi-square (p value)
		Negative		Positive		
		No. of patients	%	No. of patients	%	
Symptoms	Absent	102	62.2	31	86.1	7.04 (0.008)*
	Present	62	37.8	5	13.9	
PROM	Absent	163	99.4	32	88.9	13.35 (0.01)*
	Present	1	0.6	4	11.1	
PPROM	Absent	160	97.6	29	80.6	16.42 (0.01)*
	Present	4	2.4	7	19.4	

*P value statistically significant

Table 3: Comparison of delivery and neonatal outcomes between Nugent-positive and Nugent-negative women.

Variables	Category	Nugent				Chi-square (p value)
		Negative		Positive		
		No. of patients	%	No. of patients	%	
GA at time of delivery	>37 weeks	160	97.6	28	77.8	20.485 (0.01)*
	34-36w+6d	4	2.4	8	22.2	
Mode of delivery	LSCS	102	62.2	22	61.1	0.015 (0.903)
	NVD	62	37.8	14	38.9	
Birthweight (gm)	2000-2500	14	8.5	9	25.0	12.75 (0.01)*
	2500-3000	73	44.5	19	52.8	

Continued.

Variables	Category	Nugent				Chi-square (p value)
		Negative		Positive		
		No. of patients	%	No. of patients	%	
	3000-3500g	49	29.9	7	19.4	
	3500-4000	23	14.0	1	2.8	
	>4000	5	3.0	0	0.0	

*P value statistically significant

DISCUSSION

BV, assessed using the Nugent scoring system, was observed in 18% of participants, while 82% were negative. Renu et al, observed BV in 38.5% of symptomatic women.[7] Ibrahim et al reported BV prevalence of 17.3%.[8] Bhakta et al, reported 20.3% prevalence.[9] Jain et al found BV in 38% of women with preterm labor and 16% in term labor.[10] Age-wise distribution showed slightly higher prevalence in women aged 26-30 years (36.1%), though this was not statistically significant (p=0.58). In study by Renu et al included women aged 20-30 years, with no explicit socioeconomic status breakdown, but similarly focused on young antenatal women in the second trimester.[7] Also in study by Kiran et al showed a mean maternal age of 25.60±4.295 years in preterm labor and 25.38±4.01 years in term labor groups, which is slightly younger than the present study population but similarly within childbearing age.[11]

Socioeconomic status analysis revealed that BV was most common in the lower-middle SES group (61.1%) compared to upper-middle (27.8%) and upper-lower (11.1%), a statistically significant association (χ^2=11.85, p=0.03), indicating socio-economic status may influence BV risk. This finding is consistent with the observations of Ibrahim et al who reported a higher prevalence of BV among women with lower socioeconomic status, particularly among unemployed and less-educated individuals.[8] Similarly, the systematic review by Sethi et al identified low socioeconomic status as a significant risk factor for BV, attributing it to poor hygiene, limited healthcare access, and increased vulnerability to infections.[12] Thus, the present study reinforces the established link between socioeconomic disadvantage and increased BV risk.

The distribution of Nugent scores by gravida shows that bacterial vaginosis (positive Nugent score) was slightly higher in primigravida women (61.1%) compared to multigravida (38.9%), but the difference was not statistically significant (χ^2=3.77, p=0.052), indicating no clear association between gravida status and Nugent score in this study. This lack of association is in agreement with the findings of Das et al who also reported no significant relationship between BV and gravida status.[13] However, in contrast, Ibrahim et al observed a higher prevalence among multigravida women.[8]

The BV (positive Nugent score) was highest in women at 18-20 weeks' gestation (38.9%), while lower percentages were observed in earlier gestational periods. Also, study by Gupta et al emphasized that early gestation BV (<20 weeks) was associated with preterm delivery (23 out of 98 BV-positive women), reflecting the importance of gestational timing in BV screening.[6] There is a statistically significant association between symptoms and Nugent positivity (p<0.05). Patients without symptoms had higher Nugent positivity (86.1%), indicating possible asymptomatic cases. This highlights the silent nature of BV. In contrast, Ibrahim et al reported a strong association between symptomatic presentation (such as abnormal discharge, dysuria, and dyspareunia) and BV.[8] This discrepancy may be due to differences in study design, population characteristics, or diagnostic approaches, but it underscores the importance of screening even asymptomatic pregnant women, as a substantial proportion may harbor infection without clinical signs.

PROM was present in 2.5% overall, but was significantly higher in BV-positive women (11.1%) compared to BV-negative women (0.6%) (χ^2=13.35, p=0.01). Similarly, PPROM occurred more frequently in BV-positive women (19.4%) versus BV-negative (2.4%) (χ^2=16.42, p=0.01). Preterm births were also higher among BV-positive women (22.2%) compared to BV-negative women (2.4%), demonstrating a strong association with BV (χ^2=20.485, p=0.01).

Shahgheibi et al reported that BV was associated with adverse outcomes like preterm labor and PROM, although no significant association with abortion was noted (1.3%). Also, they reported preterm labor 3.6% and PROM 1.3%, significantly associated with BV (p<0.001).[14] Das et al found preterm delivery in 73% of BV-positive versus 25.4% BV-negative women, with mean GA at delivery 35.24±2.33 weeks in BV-positive.[13] Gupta et al observed 23/98 BV-positive women had preterm delivery, compared to 7/350 BV-negative, highlighting a significant association (p<0.0001).[6] Kwang et al reported preterm birth <34 weeks in 22.7% of BV-positive versus 6.2% BV-negative women (p=0.019).[15] The present study's findings regarding PROM, PPROM, and preterm birth among BV-positive women are consistent confirming BV as a risk factor for adverse maternal outcomes, especially preterm birth. Mode of delivery was not significantly influenced by BV, similar to other studies.

Post-partum endometritis was rare in the study population. Among Nugent-negative patients, none developed post-partum endometritis (0%). In the Nugent-positive group, only 1 patient (2.8%) developed post-partum endometritis while 35 patients (97.2%) did not, indicating a very low occurrence of the condition overall. This finding aligns

with the study by Kwang et al which did not demonstrate a significant increase in overt maternal complications such as endometritis despite BV positivity.[15] Additionally, the systematic review by Wu et al reported no significant reduction in puerperal infections with BV treatment, suggesting that while BV is linked to adverse outcomes, its direct contribution to postpartum infections may be limited.[16]

The women with a positive Nugent score had a significant higher proportion of preterm deliveries (22.2%) compared to those with a negative score (2.4%). This finding is in strong agreement with multiple studies. Gupta et al reported a significantly higher incidence of preterm delivery among BV-positive women ($p<0.001$).[6] Similarly, Jain et al and Kiran et al observed significantly increased rates of preterm labor among BV-positive cases.[10,11] Kwang et al also documented a higher incidence of preterm birth before 34 weeks in BV-positive women.[15] Furthermore, Shahgheibi et al found a significant association between BV and preterm labor, PROM, and intrauterine fetal death ($p<0.001$).[14]

Mode of delivery showed a predominance of LSCS (62%) compared to normal vaginal deliveries (38%), with no significant difference between BV-positive and BV-negative groups ($p=0.903$). Similarly, Das et al also reported that mode of delivery did not differ significantly between BV-positive and BV-negative groups, though they found a markedly higher risk of preterm delivery among BV-positive women.[13] Similarly, Gupta et al noted that BV was associated with increased preterm delivery but did not focus on delivery mode.[6] In contrast, Sahgeibi et al identified a significant association between BV and adverse pregnancy outcomes like preterm labor, though mode of delivery wasn't a focal point.[14] Overall, the present study aligns with these findings in showing no delivery mode disparity between BV groups, though other studies emphasize BV's strong link with preterm birth and adverse outcomes.

Birth weight analysis revealed that most neonates weighed between 2500-3000 g (46%), followed by 3500-4000 g (12%) and 2000-2500 g (11.5%). Low birth weight (2000-2500 g) was more common among neonates born to BV-positive mothers (25%) compared to BV-negative (8.5%), indicating a significant association ($\chi^2=12.75$, $p=0.01$). Jain et al observed BV associated with low birth weight and preterm neonates.[10] Kwang et al reported lower median birth weight, higher NICU admissions (41.7% versus 19.0%), and increased need for respiratory support in BV-positive neonates.[15] Bhakta et al similarly documented BV association with low birth weight, preterm labor, and increased NICU admission.[9]

The neonatal findings of the present study are in agreement with these studies, demonstrating that maternal BV is associated with lower birth weight, reinforcing the adverse neonatal impact of maternal BV. The study highlights that maternal BV, although present in a minority of participants (18%), was strongly associated with adverse maternal and neonatal outcomes. BV-positive women were at increased risk for PROM, PPROM, and preterm birth. Neonates born to BV-positive mothers demonstrated lower birth weights, indicating that maternal BV can significantly impact neonatal health. Mode of delivery was not influenced by maternal BV status in this cohort.

Limitations

This study has a few limitations. First, it was conducted at a single tertiary care center with a relatively modest sample size, which may limit the generalizability of the findings to other populations. Second, as an observational study, causal relationships between BV and adverse pregnancy outcomes cannot be established. Third, the diagnosis of BV was based on a single vaginal swab obtained before 20 weeks of gestation; therefore, changes in vaginal flora during the course of pregnancy could not be assessed. Finally, potential residual confounding from unmeasured maternal factors, despite statistical adjustment for selected variables, cannot be completely excluded.

CONCLUSION

The present study found a prevalence of 18% for BV among pregnant women, indicating that the condition affects a substantial proportion of the study population. While BV showed no significant association with maternal age, gravida, or mode of delivery, its prevalence was higher in women from lower-middle socio-economic status and tended to increase with advancing gestation, particularly at 18-20 weeks. Importantly, BV was significantly associated with adverse maternal and neonatal outcomes. Women with a positive Nugent score exhibited higher rates of PROM and PPROM, post-partum endometritis as well as increased incidence of preterm births. Neonatal outcomes were also adversely affected, with lower birth weights, observed in infants born to BV-positive mothers. These findings indicate that bacterial vaginosis during pregnancy is an important risk factor for both maternal and neonatal complications, underscoring the need for early detection, targeted management, and close monitoring of affected pregnancies to mitigate potential adverse outcomes.

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