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Association of Bacterial Vaginosis with Preterm Labour in Pregnant Women

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ABSTRACT

Bacterial Vaginosis (BV) was a common vaginal infection associated with adverse pregnancy outcomes, including premature birth. **Objective:** To evaluate the association between the BV and the risk of preterm Labor in pregnant women and to assess whether BV prevalence differs based on obstetric history, including parity and prior delivery outcomes. **Methods:** This case-control study was conducted in the Obstetrics and Gynecology Department at PAF Hospital Mushaf, Sargodha, from July 2022 to January 2023. A total of 130 participants were included in the study. BV was diagnosed using laboratory and diagnostic methods. Participants were enrolled using non-probability consecutive sampling. Data were analyzed using SPSS version 21.0. Chi-square tests and odds ratios were employed to assess the association between bacterial vaginosis and variables such as age, gravida, and history of preterm delivery, with a p-value ≤ 0.05 considered statistically significant. **Results:** The mean age of the participants was 25.32±6.8 years. Parity also had a notable impact, with multiparous women showing a significantly higher prevalence of BV (46.2%) compared to controls (18.2%), with an OR of 3.86; P=0.006. However, the difference among primiparous women was insignificant (P=0.477, OR=1.56). Women with no prior delivery history had a higher BV prevalence in the case group, 41.5%, compared to the control group, 20.0%, with an OR of 2.83; P=0.130. **Conclusions:** Bacterial vaginosis was significantly associated with older maternal age and multiparity, but no strong correlation was found with previous preterm delivery. Timely diagnosis and management of BV may help reduce the risk of preterm labor.

INTRODUCTION

An imbalance in the natural vaginal flora, including a reduction in lactobacilli as well as a proliferation of anaerobic bacteria like *Gardnerella vaginalis* and *Atopobium vaginae*, results in Bacterial Vaginosis (BV), a frequent vaginal illness. Preterm labor, along with preterm delivery, are among the unfavorable pregnancy outcomes that have been strongly linked to BV [1]. The intricate microbial community found in the female lower vaginal tract plays a significant role in a woman's ability to reproduce. Bacterial Vaginosis (BV), one of the most prevalent gynecologic disorders affecting women of reproductive age worldwide, can result from imbalances in this microbiota [2]. As of right now, it is known that Lactobacillus species predominate in the healthy vaginal microbiome. In contrast, *Gardnerella vaginalis*, *Prevotella*, *Bacteroides*, *Mobiluncus*, and *Mycoplasma hominis* are among the species that cause BV. Lactobacillus species are also relatively rare in BV [3]. The most typical vaginal infection among fertile women is bacterial vaginosis. The prevalence is estimated to be between 12% and 30% for premature Indian women, over 50% for women in East/Southern Africa, and less than 1% for Australian women [4]. BV has been linked to severe and expensive reproductive and obstetric complications, raising the risk of pelvic inflammatory illness, miscarriage, low birth weight, and preterm delivery for women. Inflammation occurs in the genital tract as a result of BV. Preterm labor can develop from this inflammation by inducing the release of

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prostaglandins and cytokines, which can lead to early cervical softening, membrane rupture, and contractions in the uterus [5]. Intra-amniotic inflammation and infection can result from the bacteria responsible for Bacterial Vaginosis (BV) growing through the female reproductive tract to the cervix as well as amniotic sac. It is believed that this starts the premature labor process [6]. The absence of protective lactobacilli, specifically *Lactobacillus crispatus*, diminishes lactic acid production, resulting in an alkaline vaginal environment which encourages the growth of pathogenic bacteria. This atmosphere is permissive to infections that raise the likelihood of preterm uterine contractions [7]. Preterm birth is characterized by a child being born before its 37th week of gestation. This has a significant impact on public health, as fifteen million preterm births occur each year. One of the primary causes of perinatal mortality and morbidity is preterm delivery. Preterm births can result from a number of causes, but lower genitourinary tract illnesses are one of the main ones [8, 9]. Although several variables can cause a fetal membrane to rupture prematurely, intrauterine infections have the potential to cause preterm labor activity prior to the membrane's burst. Numerous studies have demonstrated the possible connection between premature labor and bacterial vaginosis [10, 11]. A frequent vaginal infection that has been connected to unfavorable pregnancy outcomes, including preterm Labor, is Bacterial Vaginosis (BV). Despite mounting evidence of this link, there is little study examining how BV prevalence varies with mother age, parity, and delivery history, particularly in local communities. By examining the connection between BV and preterm labor in a group of expectant mothers.

This study seeked to close this knowledge gap and offer crucial information for better prenatal care. To evaluate the association between the Bacterial Vaginosis (BV) and the risk of preterm labor in pregnant women and to assess whether BV prevalence differs based on obstetric history, including parity and prior delivery outcomes.

METHODS

The study was case control study. The study was carried out in the Obstetrics and Gynecology Department at the PAF Hospital Mushaf, Sargodha for a period of six months from July 2022 to January 2023. To calculate the sample size for investigating the association between Bacterial Vaginosis (BV) and preterm labor, use a formula based on proportions for case-control studies, n = (p1−p2) 2 (Zα/2+Zβ) 2 · [p1(1−p1) + p2(1−p2)] , n = sample size, Zα/2= (1.96 or 95% confidence level), Zβ = (0.84 for 80% power), p1 = 0.50, p2 = 0.20. n= (0.50−0.20) 2 (1.96+0.84) 2 · [0.50 (1−0.50)+0.20(1−0.20)] = 130. The required sample size was N=130. The inclusion criteria included women aged 15 to 45 years with singleton pregnancies. Participants were selected from the gynecological unit of Sargodha's labor room. Following that, the patients were split up into two groups: cases and controls. All laboring women with preterm labor were categorized as cases, while all laboring women with term labor were considered controls. The inclusion criteria for the control group specified term pregnancies (≥ 37 weeks of gestation) without clinical or laboratory evidence of bacterial vaginosis (BV) and no history of preterm labor or other pregnancy complications in the current or previous pregnancies. Exclusion criteria encompassed cervical defects, fetal malformations, uterine deformities, pregnancy complications, and twin pregnancies. A comprehensive medical history was obtained, covering details about menstruation and pregnancy. Gestational age was determined using the last menstrual period, clinical examinations, and ultrasonography findings. For the control group, exclusion criteria included women with preterm pregnancies (< 37 weeks of gestation), those diagnosed with vaginal infections other than BV (e.g., candidiasis or trichomoniasis), or a history of antibiotic use within the preceding two weeks, as it could alter the vaginal flora. With both written and verbal agreement, an examination of the abdomen was done using a speculum and vagina. When the nature of the waste was identified, vaginal swabs were taken for bacteriologic testing. To get the samples, the patient was put in a dorsal supine position, and sterile cotton swabs were used to take vaginal swabs from the posterior fornix. A piece of nitrazine paper was used to measure the pH of the fluid from the vagina. More than 90% of individuals with BV possess a pH of greater than 5, and the test was sensitive. Informed consent was obtained from all participants, and approval from the Institutional Review Board (IRB) was secured for the study. This study was approved by institutional review board IRB reference number MSF(H)/308/3/1Trg, PAF Hospital Mushaf, Sargodha. The data were analyzed using SPSS version 21.0. Age and blood pressure were examples of continuous variables that were represented by the mean ± SD. Preterm along with bacterial Vaginosis were the categorical features represented by percentages and frequency. The bacterial viremia between the two groups was compared using the chi-square technique. A significant value of P<0.005 was indicated.

RESULTS

In all, 130 individuals were observed, 65 in each group. With a mean age of 25.32 years as well as a standard deviation of 6.8 years, the participants' ages vary from 15 to 45. This suggests that the population was young with a wide age range, while most participants were in the 25–30 age group. 47 women, or 36.2% of the total, were primiparous, or first-time mothers; that is, they have never given birth. 63.8% of the population, or 83 women, were multiparous, indicating they have given birth to children before. This

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indicates that most women in this research have given birth before. 44 women, or 33.8% of the total, had previously given birth. 86 women, or 66.1%, have never given birth before. This implies that first-time mothers make up a sizable part of this population. 42 women, or 32.3% of the group, tested positive for bacterial vaginosis, meaning that almost one-third of them have the illness. 88 women, or 67.7%,had negative results for bacterial vaginosis, indicating that the majority did not have the condition see Table 1.

Table 1: Sociodemographic Variables

Variables	Category	Mean ± SD / N (%)
Age	15-45 Years	25.32 ± 6.8
Parity	Primi	47 (36.2%)
	Multi	83 (63.8%)
History of Delivery	Yes	44 (33.8%)
	No	86 (66.1%)
Bacterial Vaginosis	Yes	42 (32.3%)
	No	88 (67.7%)

Table 2 showed the prevalence of Bacterial Vaginosis (BV) across different age groups in women with preterm and term pregnancies. Women aged 36 years and older had a significantly higher BV prevalence (60.0%) compared to controls (10.0%), with a strong odds ratio of 13.5 (P=0.039). In the 26-35 age group, BV was present in 47.4% of cases, but this was not statistically significant (P=0.265). For those under 25 years, 39.0% of cases had BV, also lacking significance (P=0.072).

Table 2: Influence of Age on Bacterial Vaginosis Prevalence in Preterm and Term Pregnancies (n=130)

Age	Bacterial Vaginosis	Case N (%)	Control N (%)	Odds Ratio	p-Value
<25 Years	Yes	25 (39.0%)	13 (20.0%)	2.56	0.072
	No	40 (61.0%)	52 (80.0%)	-	-
26-35	Yes	31 (47.4%)	19 (30.0%)	2.1	0.265
	No	34 (52.6%)	46 (70.0%)	-	-
≥36	Yes	39 (60.0%)	6 (10.0%)	13.5	0.039
	No	26 (40.0%)	59 (90.0%)	-	-

The prevalence of Bacterial Vaginosis (BV) in women carrying preterm and term babies was shown in the table according to parity. 38.5% of primiparous women and 28.6% of controls had BV, however P=0.477 indicates that the difference was not statistically significant. On the other hand, multiparous women had a higher risk of BV, as evidenced by their considerable BV prevalence of 46.2% compared to 18.2% in controls (Table 3).

Table 3: Influence of parity on Bacterial Vaginosis Prevalence in Preterm and Term Pregnancies

Parity	Bacterial Vaginosis	Yes N (%)	No N (%)	Odds Ratio	p-Value
Primi	Case	25 (38.5%)	40 (61.5%)	1.56	0.477
	Control	19 (28.6%)	46 (71.4%)	-	-
Multi	Case	30 (46.2%)	35 (53.8%)	3.86	0.006
	Control	12 (18.2%)	53 (81.8%)	-	-

Based on the delivery history, the table displays the prevalence of Bacterial Vaginosis (BV) in pregnant women, both term and preterm. 45.8% of those with a history of delivery had BV, compared to 25.0% of controls; nevertheless, P=0.153 indicates that this difference was not statistically significant. 41.5% of women without a history of childbirth had BV, compared to 20.0% of controls; this difference was not statistically significant (P=0.130) Table 4.

Table 4: Influence of History of Delivery on Bacterial Vaginosis Prevalence in Preterm and Term Pregnancies

History of Delivery	Bacterial Vaginosis	Yes N (%)	No N (%)	Odds Ratio	p-Value
Yes	Case	30 (45.8%)	35 (54.2%)	2.54	0.153
	Control	16 (25.0%)	49 (75.0%)	-	-
No	Case	27 (41.5%)	38 (58.5%)	2.83	0.130
	Control	13 (20.0%)	52 (80.0%)	-	-

DISCUSSION

The most common vaginal illness among both pregnant as well as non-pregnant women was Bacterial Vaginosis (BV), which was also the leading cause of vaginitis. The prevalence of BV varies between 5 and 51% in different geographical areas. Many risk factors may be associated with BV including race and ethnicity, low socio-economic status, antibiotic therapy, multiple sex partners, smoking, and young or teenage age. Nonetheless, most BV cases were asymptomatic, unreported, and untreated [12]. Preterm rupture of the membranes, PTD, and PTL have all been linked to a diagnosis of BV in the middle and late stages of pregnancy. Additionally, in one study, BV in the early stages of pregnancy was linked to an elevated risk for these unfavorable pregnancy outcomes, but not in another [13]. Preterm delivery has been the primary focus of most epidemiologic research aimed at examining the relationship between BV and unfavorable pregnancy outcomes; however, a few of these studies erroneously coupled preterm labor with a premature breakdown of the membrane. In any event, these studies have repeatedly demonstrated that women with BV, especially those identified in the first trimester of pregnancy, have a doubled chance of premature delivery [14]. A recent meta-analysis that reviewed research on the relationship between BV and preterm delivery found that pregnant women with BV had a 60 percent higher risk of premature delivery (summary odds ratio: 1.6). Fewer research has examined the relationship between BV and the outcomes of low birth weight, preterm rupture of the membranes, and premature labor [15]. 2.6-fold higher likelihood of preterm birth (95% confidence interval: 1.3, 4.9), a 6.9-fold raised threat of preterm birth (95 percent confidence interval: 2.5,

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18.8), as well as a 7.3-fold elevated risk of preterm, premature rupture of the layers (95 percent confidence interval: 1.8, 29.4), were found in the previous study that looked at several pregnancy outcomes related to BV identified during the first trimester of pregnancy [16]. Among the first studies to examine the connection between bacterial vaginosis and premature labor were Eschenbach and associates. In their investigation, bacterial vaginosis was present in 24% of the full-term group and 49% of the preterm group. Subsequent research demonstrated the link between premature labor, chorioaminiotis, and bacterial vaginosis [17]. In a previous study conducted, 27.7% of preterm patients had BV prevalence. The outcomes of the present investigation were similar to those of prior studies. A greater incidence of BV was discovered in those who had previously had an abortion in their second trimester as opposed to those who had an early abortion, according to a 1996 English study that assessed 500 instances of repeated abortion. 20% of pregnant women with no symptoms had bacterial vaginosis [18, 19]. Resolving the link between BV and premature labor was crucial for the general public's health. To improve pregnancy outcomes, strategies to lower the prevalence of BV in expectant mothers were being investigated. These strategies include education, good hygiene habits, and possible therapies [20]. Future research should explore the underlying mechanisms connecting these variables and the potential role of microbiome changes in pregnancy. Longitudinal studies examining the long-term effects of BV treatment on pregnancy outcomes will provide valuable insights.

CONCLUSIONS

Bacterial vaginosis was significantly associated with older maternal age and multiparity, but no strong correlation was found with previous preterm delivery. Timely diagnosis and management of BV may help reduce the risk of preterm labor.

Authors Contribution

Conceptualization: AQ, MA
Methodology: AQ, MA, NR, ST, SY, FZ
Formal analysis: ST, SY
Writing, review and editing: NR, ST, SY, FZ

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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