ORIGINAL ARTICLE

Exploring the relationship between bacterial vaginosis and socioeconomic factors in Bundelkhand region: A cross-sectional study

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Abstract

Bacterial vaginosis (BV) is a common condition affecting women of reproductive age, which can cause a range of adverse health outcomes. The cross-sectional study aims to investigate the association between BV and socioeconomic factors, including age groups, education level, income, and hygiene measures, in the Bundelkhand region of India, with the goal of informing public health interventions to reduce the burden of Bacterial Vaginosis. The study included 250 symptomatic pregnant women (with written consent) from different socioeconomic backgrounds and locations within the Bundelkhand region. Vaginal swabs were taken and Nugent's score was calculated to determine the presence of BV. The diagnosis of bacterial vaginosis was based on Amsel's criteria, which included the pH of vaginal secretion, the presence of clue cells, and the whiff test. The study found that the overall prevalence of bacterial vaginosis among 250 symptomatic pregnant women attending the Obstetrics and Gynaecology Department of Maharani Laxmi Bai Medical College of Jhansi was 28%. Women in the 40-49 years of age group had the highest prevalence of BV (75%), and illiterate women had the highest prevalence (39.58%). Women with poor personal hygiene had a higher prevalence of BV (42.5%) and those in the low-income group (LIG) had the highest prevalence (38%). The study suggests that age, education level, menstrual and personal hygiene, and income may be associated with the prevalence of bacterial vaginosis. This study found a high prevalence of bacterial vaginosis among women in the Bundelkhand region, with education level, menstrual hygiene, and personal hygiene being associated risk factors. Continued research and investment in public health initiatives are necessary to improve women's health outcomes and quality of life in this underserved area.

Keywords: Bacterial vaginosis, prevalence, education level, menstrual hygiene, personal hygiene, public health, Bundelkhand region.

Introduction

Bacterial vaginosis (BV) is a common condition affecting women of reproductive age, which is characterized by a shift in the vaginal microbiota from Lactobacillus dominance to an overgrowth of anaerobic bacteria. BV can cause symptoms such as vaginal discharge, odor, and itching and is also associated with adverse health outcomes such as an increased risk of sexually transmitted infections (STIs), adverse pregnancy outcomes, and pelvic inflammatory disease (PID) (Bradshaw and Brotman, 2015). The link between BV and STIs is well-established, with BV increasing the risk of acquiring STIs such as chlamydia, gonorrhea, and HIV (Kenyon *et al.*, 2013). BV has also been associated with adverse pregnancy outcomes such as preterm delivery, low birth weight, and premature rupture of membranes (Leitich and Kiss, 2007). The exact mechanisms by which BV affects pregnancy outcomes are not fully understood, but it is thought that the presence of certain bacterial species in the vaginal microbiota may trigger an inflammatory response that can lead to these adverse outcomes (Romero *et al.*, 2014). In addition to the physical symptoms and health outcomes associated with BV, the condition can negatively impact a woman's quality of life, including reduced sexual satisfaction, psychological distress, and social stigma (Brotman, 2011).

BV is highly prevalent in India, with a reported prevalence ranging from 22 to 50% among women

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attending reproductive health clinics (Gupta *et al.*, 2020; Nair *et al.*, 2019; Vanitha *et al.*, 2016). In addition to its negative health consequences, BV can also have significant economic and social implications for affected women, including reduced work productivity and increased healthcare costs (Rosenberg *et al.*, 2002).

The Bundelkhand region is a geographical region in central India, comprising parts of the states of Uttar Pradesh and Madhya Pradesh. The region covers an area of approximately 70,000 square kilometers, with a population of around 21 million people (Census of India, Chhatarpur & Jhansi, 2011). The region comprises 7 districts in Uttar Pradesh (Banda, Chitrakoot, Hamirpur, Jalaun, Jhansi, Lalitpur, Mahoba) and 6 districts in Madhya Pradesh (Chhatarpur, Damoh, Datia, Panna, Sagar, Tikamgarh). The region has faced several social and economic challenges, including poverty, lack of education, and limited access to healthcare. The literacy rate in the region is lower than the national average, and access to healthcare services is limited, particularly in rural areas. The region also faces water scarcity and drought conditions (Kumar, 2017). It has been reported to have a high prevalence of reproductive tract infections (RTIs), including BV (Choudhary *et al.*, 2017). However, there is limited research on the relationship between BV and socioeconomic factors in this region.

Therefore, the main aim of this cross-sectional study is to explore the relationship between BV and socioeconomic factors in the Bundelkhand region. Specifically, we aim to investigate the association between BV and factors such as various age groups, education level, menstrual and personal hygiene and income. This study has important implications for understanding the factors that contribute to BV in the Bundelkhand region and for informing public health interventions to reduce the burden of this infection in India.

Materials and Methods

A total of 250 samples were randomly collected from selected symptomatic pregnant women (with their written consent) lying in any gestational week, attending the OPD/IPD (outpatient department/in patient department) of Obstetrics and Gynaecology Department of Maharani Laxmi Bai Medical College of Jhansi with universal safety precautions. The women included in the study were from different socioeconomic backgrounds and locations within the Bundelkhand region (as per the questionnaire included in the study). High vaginal swabs (from the posterior fornix) were taken for all the participants under aseptic conditions.

Clinical Approach to diagnose Bacterial Vaginosis

The presumptive diagnosis of bacterial vaginosis was made based on Amsel's criteria, which include the pH of vaginal secretion, the presence of clue cells by wet mount examination, and by performing the whiff's tests, which was done by adding 10% KOH (potassium hydroxide) on the

Table 1: Nugent's scoring of vaginal swabs for diagnosis of bacterial vaginosis

Morphotype	Number of organisms per oil immersion field				
	None	<1	1-4	5-30	>30
Lactobacillus species	4	3	2	1	0
Gardnerella & anaerobic Gram negative bacilli	0	1	2	3	4
Curved Gram negative bacilli (Mobilincus species)	0	1	1	2	2

Table 2: Number based on average of 10 fields

Interpretation of Nugent's score		
Nugent's score	And	Interpretation
0-3	No clue cells	Normal vaginal flora
4-6	No clue cells	Intermediate or Not consistent with Bacterial vaginosis
4-6	Clue cell present	Indicative of bacterial vaginosis
≥ 7	Clue cell present or absent	Indicative of bacterial vaginosis

swab. Nugent's score was further calculated to determine the presence of BV. The Nugent score is a method used to diagnose bacterial vaginosis (BV) based on examining a vaginal smear under a microscope. It involves the assessment of three types of bacteria present in the vaginal flora - *Lactobacilli, Gardnerella vaginalis*, and *Mobilincus* species (Table 1 and 2) (Nugent *et al.*, 1991). A score ranging from 0 to 10 is assigned based on the presence and abundance of each type of bacteria. The composite score is categorized into 3 groups ranging 0 to 3 being normal, 4 to 6 as intermediate and 7 to 10 as definite bacterial vaginosis.

Results

The study collected data from 250 symptomatic women to investigate the relationship between various factors and the prevalence of BV. The study's main findings indicate that the overall prevalence of BV among the participants was 28%. Among the age categories, women in the 20 to 29 age group had the prevalence of BV (28.5%), those in the 30 to 39 age group (25.3%). The prevalence of BV among women in the 40 to 49 age group was relatively higher (75%). However, this was not statically significant. (Chi-square test, *p-value* =0.09) (Table 3).

Regarding education levels, the highest prevalence of Bacterial Vaginosis was observed among illiterate women (39.58%), followed by those who completed up to the 8th grade (33.85%). The prevalence decreased as education level increased, with graduate/postgraduate to 13.3% or professional women having the lowest prevalence (6.67%). (Figure 1 & Table 4)

In terms of age of marriage, there was no significant difference in the prevalence of BV between the different age groups. The positive BV rate was significantly higher in women who used homemade pads than those who used commercial pads (35.00% vs. 15.60%, p=0.006) (Table 5). There is a significant difference in the positive BV rates between commercial pads and homemade pads. This suggests that the type of menstrual hygiene products used may play a role in the development of BV. However, women who reported poor personal hygiene (Pelvic area) had a higher prevalence of BV (42.5%) compared to those with good (11.1%) or average (35.8%) personnel hygiene (Figure 2).

Table 3: Prevalence of bacterial vaginosis in pregnant women by age category

Age category	Number of samples	Positive BV samples	BV frequency (%)	p-value
20–29 years	151	43	28.5	
30–39 years	95	24	25.3	
40–49 years	04	03	75	0.09
Total number of samples	250	70	28	

The location of the participants' homes in relation to Jhansi Medical College did not seem to be a significant factor in the prevalence of BV, whereas in terms of income, women in the low-income group (LIG) had the highest prevalence of BV (38%), followed by those in the middle-income group (MIG) (22.6%). Women in the high-income group (HIG) had the lowest prevalence of BV (17.1%). However, the statistical analysis proves that there is no significant difference in the positive BV rates among different income groups (Table 6). **Note:** The income groups are categorized as LIG (Low Income Group- annual income Rs. 15,000 - Rs. 1,00,000), MIG (Middle Income Group - annual income Rs. 1,00,001 - Rs. 5,00,000), and HIG (High Income Group- annual income more than Rs. 5,00,000).

Overall, the study suggests that a high prevalence of BV among women in the Bundelkhand region, highlighting the need for increased awareness and education about the condition and its risk factors. Certain factors, including

Figure 1: Bacterial Vaginosis prevalence with respect to Education Level
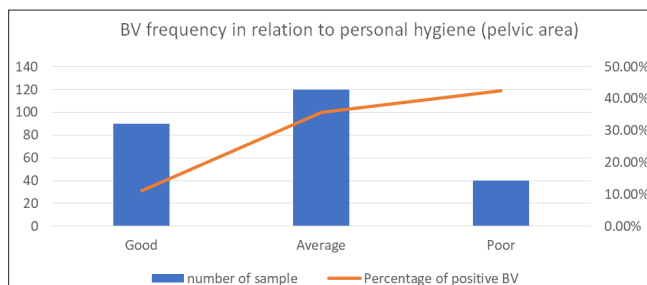
Figure-2: Bacterial vaginosis prevalence with respect to personal hygiene (pelvic area)

Table 4: Prevalence of bacterial vaginosis across different education levels

Education Level	Number of samples	Positive BV samples	Positive BV rate (%)
Illiterate	80	31	39.58
Up to 8th Grade	65	22	33.85
9th to 12th Grade	60	15	25.00
Graduate/ postgraduate	30	4	13.33
Professional	15	1	6.67

Table 5: BV samples by menstrual hygiene level with positive BV rate

Menstrual hygiene category	Number of samples	Positive BV samples	Positive BV rate	p-value
Commercial Sanitary Pads	90	14	15.60%	0.006
Home-made Pads	160	56	35.00%	

Table 6: BV prevalence among different income groups

Income group	Number of samples	Positive BV samples	Positive BV rate (%)	p-value
LIG	100	38	38	0.175
MIG	115	26	22.6	
HIG	35	6	17.1	

education level, menstrual hygiene, and personnel hygiene, were significantly associated with BV, suggesting that targeted interventions in these areas may help reduce the prevalence of BV. The results of this study can inform public health policies and programs aimed at reducing the burden of BV in the region. For example, interventions focused on improving menstrual hygiene and promoting the use of hygienic sanitary products, such as commercial pads, may be effective. Additionally, education campaigns to improve personnel hygiene and promote proper cleaning techniques may also be beneficial. Overall, the study provides important insights into the prevalence and risk factors associated with BV in the Bundelkhand region, which can help improve the health and well-being of women in this area.
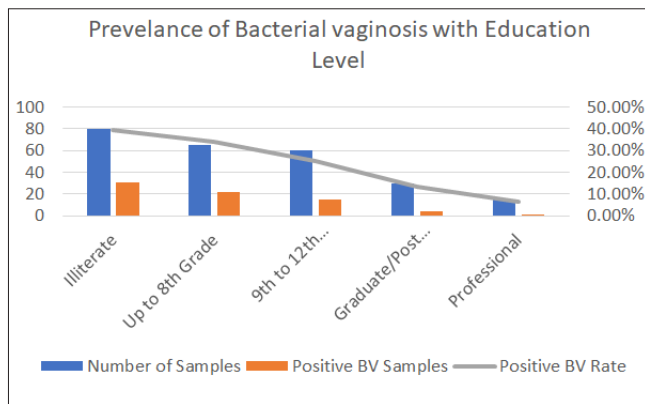
Discussion

This is the first epidemiological study conducted in the Bundelkhand region with the aim of assessing the prevalence of bacterial vaginosis among pregnant women with respect to various socioeconomic and demographic factors). No study has assessed the prevalence of BV among pregnant women in Uttar Pradesh's Bundelkhand Region. However, similar studies have investigated the prevalence and risk factors of bacterial vaginosis (BV) among women (asymptomatic and non-pregnant) in different regions of India (Khanna *et al.*, 2017; Rathi *et al.*, 2016).

The findings of this study have several implications for understanding the prevalence and risk factors associated

with BV among women in the Bundelkhand region. This study found a high prevalence of BV among women in the region, with nearly 28% of the sample testing positive for the condition. This finding is consistent with previous studies that have reported high rates of BV among women in India and other developing countries (Singh *et al.*, 2011; Thoma *et al.*, 2018). The study also found that several factors were significantly associated with BV, including education level, menstrual hygiene, and personnel hygiene and income group. Specifically, the study found that women with higher levels of education were less likely to have BV and that the use of hygienic sanitary products, such as commercial pads, was associated with a lower prevalence of BV. These findings are consistent with previous research that has linked educational attainment and menstrual hygiene practices with a reduced risk of BV (Begum *et al.*, 2013; Van de Wijgert *et al.*, 2000). The study also showed that women who reported poor personnel hygiene had a higher prevalence of BV. This finding is consistent with previous research that has linked poor genital hygiene with an increased risk of BV (Low *et al.,* 2011) but this study did not find any significant associations between BV and age, age of marriage, primiparous status, distance from medical college or income level.

It is important to note about this study that it has several limitations. Firstly, the sample size is relatively small, which may limit the generalizability of the findings to the wider population of women in the region. Additionally, the study relied on self-reported data, which may be subject to recall bias or social desirability bias. Future research should aim to address these limitations by using larger samples and more objective measures of BV and hygiene practices.

Conclusion

This study provides information about the commonness and potential risk factors linked to bacterial vaginosis (BV) among women living in the Bundelkhand region. The study found a high prevalence of BV, with certain factors such as education level, menstrual hygiene, and personnel hygiene significantly associated with the condition. These findings have important implications for public health in the region, highlighting the need for increased awareness and education about BV and its associated risk factors. It also suggests that targeted interventions in areas such as menstrual hygiene and personnel hygiene may be effective in reducing the prevalence of BV. By implementing public health policies and programs aimed at improving hygiene practices and promoting the use of hygienic sanitary products, it may be possible to reduce the burden of BV and improve the health and well-being of women in the region. Overall, this study underscores the need for continued research and investment in public health initiatives aimed at addressing BV and other reproductive health issues among women in the Bundelkhand region. By prioritizing these efforts, improving the health outcomes and quality of life for women in this underserved area may be possible.

Conflict of interests

No conflict of interests is declared

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