

Prevalence and Correlates of Bacterial Vaginosis among Young Women of Reproductive Age at a Tertiary Care Hospital, WarangalSubuhi Kinan¹, K. Pradeep Kumar², Golla Eshwara Chandra³¹Senior Resident, Department of Microbiology, Government Medical College and Hospital, Mahabubabad, Telangana State.²Associate Professor, Department of Microbiology, Government Medical College and Hospital, Mahabubabad, Telangana State.³PG, Department of Microbiology, Government Medical College and Hospital, Mahabubabad, Telangana State.

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Abstract**Background:** Bacterial vaginosis (BV) is a prevalent polymicrobial infection and one of the leading causes of abnormal vaginal discharge in sexually active women of reproductive age. This cross-sectional study aims to assess the prevalence of vaginal infections in women aged 15 - 50 years who are seeking care at the Obstetrics and Gynecology Department, primarily due to complaints of increased vaginal discharge.**Methods:** This prospective study had prior approval from the Institutional Ethics Committee. Women were enrolled following local ethics committee guidelines and with informed consent. Questionnaires were used to collect sociodemographic, behavioral, medical, reproductive, and sexual history. Patients with noticeable vaginal discharge in the Outpatient Department were assessed for inclusion. They were questioned about their symptoms, discharge characteristics, itching, medical history, and prior treatments before undergoing a physical examination.**Results:** In the present study of the 100 cases BV was found in high frequency in the age group 31-40 years (59%) followed by 21-30 years (27%), 41-50 years (9%), and lowest in 15-20 years (5%). Vaginal *candidiasis* was highest in 21-30 years (46%) followed by 15-20 years (35%), 21-40 years (32%) then by 41-50 years (11%). *Trichomoniasis* was highest in 31-40 years (57%) followed by 41- 50 years and 21-30 years (28%). *N. gonorrhoea* was highest in 41-50 years (75%) followed by 21-40 years (25%). Mixed infections were detected in 41-50 years (50%) followed by 21-30 years (33%) then 41-50 years (16%)**Conclusion:** The high prevalence of BV is linked to hygiene habits and sociodemographic factors, emphasizing the need for structured healthcare education programs to reduce its incidence and guide resource allocation for future interventions. Among 100 cases, some showed disparities between clinical and laboratory diagnoses, often due to challenges in clinically identifying the causative agent or obscured findings from prior treatments. Therefore, it's vital to correlate clinical and laboratory results to prescribe precise treatments.**Keywords:** Bacterial Vaginosis, Epidemiology, Young females, Prevalence, Sociodemographic determinants.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Bacterial vaginosis (BV) is a prevalent vaginal syndrome, primarily due to an overgrowth of *Gardnerella vaginalis* in reproductive-aged women. This condition is characterized by a shift from the typical *Lactobacillus*-dominant vaginal flora to a more diverse microbial environment, often comprising commensal anaerobic bacteria. [1] Clinically, BV is marked by symptoms such as profuse vaginal discharge, a fishy odor, and elevated vaginal pH (> 4.5). [2] Nevertheless, up to 50% of affected women may remain asymptomatic. BV is associated with various reproductive and obstetric complications, including preterm birth,

low birth weight, and a higher risk of sexually transmitted infections. [3] Despite its prevalence and consequences, BV's exact causes and natural history are not well understood. Vaginitis refers to inflammation of the vagina and is typically characterized by symptoms such as vaginal discharge containing many white blood cells (WBCs), vulvar itching, irritation, vaginal odor, erythema, dyspareunia, and dysuria. [4] The three most common infectious causes of vulvovaginitis are BV, *candidiasis*, and *trichomoniasis*. BV is especially common among women of childbearing age and has been linked to co-infections with

Trichomonas vaginalis, *candida*, *Neisseria gonorrhoeae*, and HIV. [5] It's essential to recognize that many BV cases are asymptomatic or present with only malodorous vaginal discharge, leading to its classification as "vaginosis" rather than "vaginitis". [6] *Lactobacillus* bacteria play a critical role in maintaining the vagina's acidic environment, inhibiting the growth of other microorganisms. However, changes in the vaginal flora can result in increased pH levels and create conditions conducive to the overgrowth of various anaerobic and facultative bacteria.

A variety of bacteria, including Gram-positive cocci, Gram-negative rods, and anaerobic species like *Gardnerella vaginalis*, are commonly found in the vaginal microbiota of healthy women. [7] A reduction in the population of *lactobacilli* can lead to opportunistic bacteria becoming dominant, potentially causing infections and abnormal vaginal discharge. The vaginal pH typically ranges from 3.5 to 4.5 during puberty and menopause, creating an environment that inhibits the growth of pathogenic organisms. [8] In pregnancy, vaginal infections can lead to complications for both the mother and the neonate, increasing the risk of gynecological and obstetric issues. Additionally, BV is associated with a higher risk of acquiring HIV and other sexually transmitted diseases. It may be considered a "Sexually Enhanced Disease" due to its connection to sexual activity. Several risk factors and behaviors are linked to BV, including age, marital status, antibiotic use, douching, sexual activity, early sexual debut, STDs, occupation, smoking, alcohol intake, contraceptive use, and race/ethnicity. Studies suggest that women using hormonal contraceptives may have a reduced risk of recurrent BV. [9, 10]

Candidiasis, characterized by the presence of *Candida* species, such as *C. albicans*, *C. glabrata*, and *C. tropicalis*, is another common cause of vulvovaginitis. [11] Many women may carry *Candida* asymptomatically, with symptoms often including curd-like vaginal discharge, itching, and erythema. *Trichomoniasis*, caused by *Trichomonas vaginalis*, is the most prevalent nonviral sexually transmitted protozoal infection globally. [12] It is now recognized as a significant source of reproductive morbidity and a facilitator of HIV transmission and acquisition. Symptoms include profuse purulent discharge, burning, pruritus, dysuria, frequency, and dyspareunia. *Gonorrhea*, primarily caused by *Neisseria gonorrhoeae*, is a common sexually transmitted disease. In females, it can lead to purulent cervicitis, while in males, it can cause urethritis. Mucopurulent cervicitis is the most common presentation and is a significant cause of morbidity among sexually active individuals worldwide. The current study aimed to

identify the prevalence of bacterial vaginosis in women of reproductive age group.

Material and Methods

The study material was obtained from female patients of reproductive age, ranging from 15 to 50 years, who visited the Gynaecology and Dermatology outpatient Department at Kakatiya Medical College and Mahatma Gandhi Memorial Hospital, Warangal, between January 2020 and September 2021. This research was conducted as a prospective study. All procedures and protocols used in this study had received prior approval from the Institutional Ethics Committee. Enrolment of women into the study was carried out following the guidelines of the local ethics committee, and informed consent was obtained. To gather information on sociodemographic details, behavioral characteristics, as well as medical, reproductive, and sexual history, questionnaires were administered. All patients with noticeable vaginal discharge who visited the Outpatient Department (OPD) were assessed for potential inclusion in the study. Participants were queried about their symptoms, specifically regarding the characteristics of their complaints such as the color and volume of discharge and the presence of itching. Their medical history and any previous treatments they had received were also documented before undergoing a physical examination.

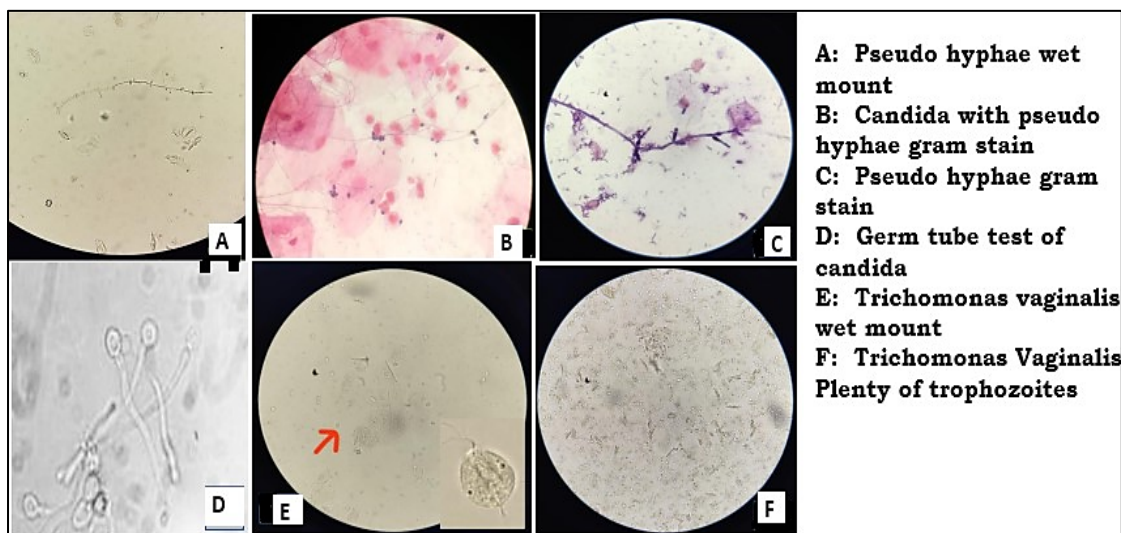
Inclusion Criteria: Patients in the reproductive age group, aged between 15 and 50 years, experiencing vaginal discharge, were eligible for inclusion.

Exclusion Criteria: Patients who declined to participate and those with vaginal bleeding were excluded from the study.

A total of 100 women of reproductive age group with complaints of vaginal discharge were selected for this study at random after applying the criteria mentioned above. With prior consent, a comprehensive history, general examination, and gynecological examination were initially carried out. After making a clinical diagnosis, a sterilized un-lubricated Cusco's vaginal speculum was inserted into the vagina, and characteristics of the discharge with respect to amount, odor, color, and type of discharge were evaluated. Any pathology of the vagina and cervix such as vaginitis, discharge, cervicitis, and cervical erosions was looked for. The amount, color, character, and smell of the vaginal discharge were noted. The discharge was then collected by three sterile cotton-tipped swabs from the upper part of the posterior fornix. The pH was measured using litmus papers ranging from 2 to 10 by directly dipping the pH strip in the vagina. Colour change was observed and matched against the indicator.

Three vaginal samples were taken, and one swab was used for making a wet mount to look for the motility of the TV. The second swab was used for making smears for Gram staining to find out clue cells, Gonococci. The third swab was used to do a 10% potassium hydroxide (KOH) mount to look for *Candida*. For microbiological diagnosis of bacterial vaginosis, vaginal smear slides were air dried, Gram-stained, and examined under oil

immersion objective (1000x magnification) and graded as per standardized, quantitative, morphological classification method developed by Nugent et al. [13] In the present study, the microbiological definition of BV was a score of 7–10 by Nugent's method. In the present study, VVC was diagnosed based on clinical symptoms of vaginitis and direct microscopic examination.



A: Pseudo hyphae wet mount
B: Candida with pseudo hyphae gram stain
C: Pseudo hyphae gram stain
D: Germ tube test of candida
E: Trichomonas vaginalis wet mount
F: Trichomonas Vaginalis Plenty of trophozoites

Statistical Analysis: All the available data was uploaded to an MS Excel spreadsheet and analyzed by SPSS version 21 in Windows format. Continuous variables were represented as mean, standard deviations, and percentages. Categorical variables were represented by p values and the p values of (<0.05) were considered as significant.

Results

Of the 100 cases, BV was the most common microbiological cause accounting for a prevalence of 44(44%), followed by vaginal candidiasis 28(28%), trichomoniasis 8(8%), *Neisseria gonorrhoea* 4(4%), mixed infections 6(6%) and normal flora 10(10%). In mixed infections among 6 cases, 3 cases are bacterial vaginosis and candida, 2

cases are TV and BV, and 1 case of *gonorrhoea* and candida.

In the present study of the 100 cases, BV was found in high frequency in the age group 31-40 years (59%) followed by 21-30 years (27%),41-50 years (9%) and lowest in 15-20 years (5%). Vaginal candidiasis was highest in 21-30 years (46%) followed by 15-20 years (35%),21-40 years (32%) then by 41-50 years (11%). Trichomoniasis was highest in 31-40 years (57%) followed by 41-50 years and 21-30 years both (28%). *N. gonorrhoea* was highest in 41-50 years (75%) followed by 21-40 years (25%). Mixed infections were detected in 41-50 years (50%) followed by 21-30 years (33%) then 41-50 years (16%) depicted in Table 1.

Table 1: Prevalence of organisms causing vaginal discharge in different age groups

Pathogen	N	15 – 20		21 - 30		31 – 40		41 - 50	
		N	%	N	%	N	%	N	%
Bacterial vaginosis	44	2	5	12	27	26	59	4	9
Vaginal candidiasis	28	3	35	13	46	9	32	3	11
Trichomoniasis	8	0	0	2	28	4	57	2	28
N Gonorrhoea	4	0	0	0	0	1	25	3	75
Mixed infections	6	0	0	2	33	1	16	3	50
Normal Flora	10	5	50	1	10	3	30	1	10

Of the examination of 100 cases with symptomatic vaginal discharge highest frequency of all the organisms is seen in 31-40 years (46%). The majority of the cases are illiterate with a frequency of 75%. 70% of the cases are unemployed, 80% of cases are more common in married women and 68% of cases with all organisms belonged to rural areas.

Table 2: Frequency distribution of patients by type of organism

	Characteristics	N	SV	VC	TV	Mixed Infections	Normal Flora
Age	15 – 20	10	2	3	0	0	5
	21 – 30	30	12	13	2	0	1
	31 – 40	46	26	9	4	1	3
	41 – 50	14	4	3	2	3	1
Educational Level	Illiterate	75	34	3	7	0	7
	Literate	25	10	21	1	4	3
Occupation	Employed	30	8	7	5	1	2
	Unemployed	70	36	11	3	3	8
Marital life	Married	80	38	26	7	0	8
	Unmarried	20	6	2	1	4	2
Local	Rural	68	33	18	4	3	9
	Urban	32	11	10	4	1	1

Of the examination of 100 cases with symptomatic vaginal discharge age-wise distribution of bacterial vaginosis, a maximum number of cases are seen in 31-40 years (56%) followed by 21-30 years (40%), 41 - 50 years (28%) and least in 15-20 years (20%). The table also shows that 31-40 years ($p < 0.010$) is the statistically significant age group for BV. BV relation to literacy, wherein a maximum number of BV cases are illiterate accounting for (45%) followed by beyond 5th standard (42%) and up to

5(38%). In the present study, it is seen that literacy is not significantly related to BV ($p = 0.750$). BV prevalence was higher among unemployed (housewives) 51% who in addition to household chores beedi making, betelnut chopping chili cleaning at home, followed by commercial sex workers who had a prevalence of 37% and laborers 22%. In the present study, occupation is significantly associated with BV ($p = 0.025$) depicted in Table 3.

Table 3: Distribution of bacterial vaginosis about the occupation

Occupation	Number of cases studied	Number of BV positive	Percentage (%)	P value
Unemployed (housewives)	70	36	51%	0.025*
Labourers	22	5	22%	
Commercial sex workers	8	3	37%	

* Significant

The prevalence of BV is maximum among married women accounting for 47% followed by divorce at 33% and women who are single at 29%. In the present study, there was no significant relation between marital status and BV ($p = 0.250$) depicted in Table 4.

Table 4: Prevalence of BV about marital status

Marital status	Number of cases studied	BV positive	Percentage	P value
Married	80	38	47%	0.250
Single	17	5	29%	
Divorce	3	1	33%	

Based on the locality 45% of BV-positive cases are from rural areas and 32% are from urban areas. Based on contraception use 40% of women used contraception and 44% did not use any contraception. 40% gave a history of alcohol

consumption and antibiotic usage in the past month. Contraception usage posed a significant risk for BV ($p = 0.001$) whereas locality, alcohol consumption, and antibiotic usage are not significant risk factors for BV (Table 5)

Table 5: Prevalence of BV based on other socio-demographic parameters

Parameters		Cases studied	BV positive	Percentage	P value
Locality	Rural	68	34	45	0.1
	Urban	32	10	32	
Contraception	Yes	10	4	40	0.001*
	No	90	40	44	
Alcohol	Yes	20	8	40	0.750
	No	80	36	45	
Antibiotic usage in the past 1 month	Yes	45	18	40	0.50
	No	55	26	47	

* Significant

Characteristics of vaginal discharge of patients differed according to pathogenic agents. The pH in many cases was >5 which included women with BV, TV, and *N. gonorrhoea*. In women suspected of *candida* infection, the pH was slightly below the normal value <4.5 . Whiff amine test was positive in 45% of patients, mostly those who have BV, and in a few cases of TV. Vaginal discharge was examined for the infection. out of 100 patients, 50% patients had homogenous white discharge suggestive of BV, 30% had curdy thick white discharge suggestive of vaginal *candidiasis*, 10% had frothy yellow to green and 10% had a mucopurulent discharge.

Nugent scoring in all 100 cases, for diagnosis of BV gram staining was done for Nugent scoring. It has a scoring system of 0-10 wherein 0-3 is normal, 4-6 is intermediate and 7-10 is criteria for BV. In the present study, 45% of cases had a score of 7-10, 30% had a score of 4-6, and 25% had a score of 0-3. Upon examination of 100 patients with symptomatic vaginal discharge, the overall prevalence of BV was 44% based on Nugent's scoring system. The highest number of BV cases was seen among the 31-40 years age group (59%) and the least BV cases were seen in patients in the age group of 15-20 (5%). Married women were more prone to BV.

Discussion

Vaginal discharge is a common health problem among women in the reproductive age group. Whether asymptomatic or symptomatic, it is usually neglected by women making the diagnosis more difficult and leading to adverse outcomes in pregnancy due to the availability of over-the-counter drugs and not completing the treatment protocol leading to an increase in resistance and recurrences. Among the 100 cases with vaginal discharge, the majority of the patients were in the age group 31 – 40 years (46%) might be because they belong to the sexually active age group. However, this was not statistically significant. There was a significant association with both literacy level and employment status in contrast to Al Quaiz et al. [14] study where the infection rates were highest among secondary school and university graduates.

The majority of BV (45%) occurred in illiterates which is similar to Venugopal et al. [15] where BV was common in illiterates (56%) but was in contrast to Al Quaiz [14] study where BV was common among educated people. Most of the vaginal *candidiasis* (55%) cases occurred in the literature which is similar to Al Quaiz's [14] study, and about 60% of TV infections were isolated from the literate group. Bacterial vaginosis (BV) 44% was the most common microbiological cause of abnormal vaginal discharge in our study. This is

comparable to the study of Gupta et al. [16] found that 139 women reported, BV was the most common cause of genital tract infections as it was found in 44.6% of women. Similar results were shown by Sujatha A. et al. [17] where bacterial vaginosis was found to be 46%. Nessa et al. [18] in Bangladesh reported 48.1% cases of BV among sex workers which is a little higher than our study. Lateef et al. [17] in Nigeria had a prevalence of 40.1% among non-pregnant asymptomatic women. The variations in the prevalence could be related to geographical distribution or systematic differences in the various population samples and sample sizes. However, there is continuing controversy about its importance as a pathogen and its ability to cause vaginitis.

BV was found in high frequency in the age group of 31 – 40 years (59%) followed by 21 – 30 years (27%), then by 41-50 and 15-20 years (14%). The peak age of BV in this study was 31-40 years similar to the findings of Eliza Ranjith [19] they observed the highest prevalence of BV among the age group of 31-40 years (60.16%) and the least among those below 20 years of age. Similarly, a study done by Sujatha A et al. [17] had the highest prevalence in the age group of 31-35 years (28%) and the least in 15-20 years (8%) of age. However there was no statistically significant association found between age and infection in studies by Al Quaiz, [14] Madhivanan et al. [20] who reported that BV is more common in younger age groups. Garba et al. [21] in Nigeria found BV to be most prevalent among the 26-30 years age group (35.8%) and least in >40 age (10.5%). The highest prevalence in the age group 31-40 years might be due to the age being the most reproductively active age group and high sexual exposure at this age. According to the present study married women were at higher risk (47%) compared to unmarried which include both single and divorced (30%), which is similar to the study by A Lateef et al. [17] and Gad et al. [22] in Egypt. However, many studies have documented the occurrence of BV in sexually inactive females or virgins. This provides evidence that sexual activity is not a prerequisite for BV. Lifestyle change, improper perineal care, tight clothing, lack of attention towards menstrual hygiene, and sedentary factors might be the reasons for the acquisition of BV in unmarried women. Similarly illiterate women had the highest BV prevalence of (45%) which is similar to E Ranjith [19] which had a prevalence of (29.1%) but differs from Ibrahim SM et al. [23] who recorded (54%) in those with primary education in Nigeria. Illiterates lack education, hesitance to approach a female consultant and sociocultural structure might be the cause of higher prevalence of BV among illiterates.

In the present study, a higher rate of BV was seen in women who are housewives (51%) whereas a

higher rate of BV was seen among laborers (farmers) in a study by Eliza Ranjith et al. [19] Among the employed (37%) of women with BV positive are involved in commercial sex work. The majority of the BV-positive cases are from rural backgrounds (45%), similar to the study by Sujatha A et al. [17] (20%) which differs from Bhalla et al. [24] in New Delhi where a high percentage was diagnosed in urban slums (38.6%) and (28.8%) in a rural area. This may be because of the difference in way of living, and lack of awareness in the maintenance of personal hygiene and sexual behaviour among women and their partners. Moreover, women who used contraceptive methods had (a 40%) prevalence of BV compared to (44%) who did not use any contraceptive methods which is in contrast to A Lateef et al. [17] where IUD users had a higher prevalence of BV (68%). This might be due to poor hygiene or the high-risk behavior of a sexual partner. The study showed no significant association between the consumption of alcohol and antibiotic usage within the past month. But alcohol intake causes depletion of hydrogen peroxide-producing lactobacilli and may act by depleting Langerhans cells in the cervical epithelium leading to immunosuppression Eliza Ranjith et al. [19] Moreover, women with BV have higher chances of acquiring HIV. Consistent with other studies *trichomoniasis* and *candidiasis* were associated with BV in our study similar to Venugopal et al. [15] and Madhivanan et al. [20].

Vaginal *candidiasis* (28%) was the second most common microbiological etiology of abnormal vaginal discharge in our study which is nearly similar to 22% by Venugopal et al. [15] study. Sujatha A. et al. [19] showed a higher prevalence than the present study (44%). The most common age group affected by vaginal *candidiasis* was the 21-30 (46%) and 15-20 years (35%) followed by 31-40 (32%) and 41-50 years (11%) similar to the findings of Nwadioha et al. [25] also reported a similar result of increased prevalence in younger age group because of increased sexual activity in this age group. *Candidiasis* is not usually a sexually transmitted disease; however, male contacts could be possibly involved. Among the isolates *C. albicans* (60%) was the most common which was similar to Anh DN et al. [26] who had a prevalence of (51%) among symptomatic nonpregnant women of reproductive age in Vietnam. *Trichomoniasis* (8%) was the third common microbiological etiology of abnormal vaginal discharge in our study. It was detected at the highest rate in the age group of 31-40 years in contrast to Bachmann et al.'s study [27] Venugopal et al [15] which showed a prevalence of 20% and 25% among women of 40-50 years. This high prevalence may be due to the high-risk nature of the group that was studied. It is the most prevalent non-viral sexually transmitted disease in the world

(Bailey and Scott's), most of the women infected have a history of multiple sex partners and are HIV positive. *N. gonorrhoea* accounted for 4% of the cases which was similar to the study of Zenebe et al. [28] which showed a prevalence of 4.3% among pregnant women in Ethiopia this was detected in the highest rate in the age group of 41-50 years which was in contrast to many studies which was common in 25-40 years. The combination of two pathogens has been investigated in the present study which was 6%. In our study, 3% of cases presented with combined infection (BV + vaginal *candidiasis*) similar to the study by Venugopal et al. [15].

In the present study, 2% of cases had mixed infection of BV and trichomoniasis similar to the study by Madhavanan et al. [20] The cross-sectional nature of this analysis did not allow us to establish the temporality of these infections. It is plausible that *T. vaginalis* infection alters the vaginal ecology and facilitates the development of BV, or that women with BV have lost natural protection against genital tract infections leading to the acquisition of STIs like *T. vaginalis* infection. 1% had *gonorrhoea* and *candidiasis*. These patients were of a higher age group and had a history of multiple sex partners.

Conclusion

The high prevalence of BV is linked to hygiene habits and sociodemographic factors, emphasizing the need for structured healthcare education programs to reduce its incidence and guide resource allocation for future interventions. Among 100 cases, some showed disparities between clinical and laboratory diagnoses, often due to challenges in clinically identifying the causative agent or obscured findings from prior treatments. Therefore, it's vital to correlate clinical and laboratory results to prescribe precise treatments. Clinicians should consider evolving epidemiological data, as the color and quantity of vaginal discharge may not always indicate the specific disease. This study underscores the role of laboratory investigations in avoiding misdiagnoses, given the risk of self-treatment with non-prescription drugs by women with vaginal complaints and potential misdiagnoses by healthcare providers. Timely BV treatment is crucial for reproductive-age patients to reduce the risk of HIV transmission. Early diagnosis and treatment can also benefit pregnant women.

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