EAHRC
EAST AFRICAN HEALTH RESEARCH COMMISSION
Research for Health and Prosperity

ORIGINAL ARTICLE

Prevalence and Microbial Distribution of Bacterial Vaginosis Among Women of Reproductive Age at Kilimanjaro Christian Medical Centre: A Three-Year Retrospective Laboratory Based Study

Ezekiel B. Gamuya,[a] Emmanuel T. Issangya,[b] Adam Mwakyoma,[c] Ican E. Maguga,[a] Simon Manyata,[b] Debora C. Kajeguka,[b] Dhahiri Mnzava[b*]

[a]Benjamin Mkapa Hospital, Dodoma, Tanzania; [b]KCMC University, Kilimanjaro, Tanzania; [c]KCMC Hospital, Kilimanjaro, Tanzania

Correspondence to Dhahiri Mnzava (dhahirim@gmail.com)

ABSTRACT

Background: Bacterial vaginosis is a prevalent and often asymptomatic vaginal condition affecting women of reproductive age, posing significant reproductive health risks. Despite its importance, data on BV prevalence, microbial profiles, and associated factors at Kilimanjaro Christian Medical Centre, a major tertiary hospital in northern Tanzania, remain limited. Therefore, this study aimed to address these gaps.

Methods: This was a three-year retrospective laboratory based study of 891 high vaginal swab samples collected from women aged 15–49 years at KCMC between January 2021 and December 2023. Bacterial vaginosis was diagnosed using Amsel criteria and Nugent scoring. Demographic and clinical data were retrieved from the hospital electronic medical system. Data were analysed using descriptive and inferential statistics. *P* value of <.05 was considered statistically significant.

Results: Overall prevalence of bacterial vaginosis was 324 (36.4%). The majority of the studied vaginal samples belonged to women aged 25–34 years 359 (40.3%), and most samples were collected from the Outpatient Department 618 (69.4%). Microbiological analysis revealed that no bacterial growth was the most common finding 565 (63.4%), followed by ***Candida albicans*** 205 (23.0%) and ***Escherichia coli*** 58 (6.5%). In multivariable logistic regression, attendance at the Labour Ward was significantly protective against BV (AOR = 0.096; 95% CI: 0.012–0.787; *P*= .029), while the year of sample collection also predicted BV: samples from 2022 had reduced odds (AOR=0.63; 95% CI: 0.40–0.96; *P*=.035), and samples from 2023 had increased odds (AOR=2.24; 95% CI: 1.51–3.32; *P*<.01) compared to 2021. Age category and individual microorganisms were not independent predictors of BV.

Conclusion: This study showed a high prevalence of bacterial vaginosis (36.4%) with flactating trend among women of reproductive age at KCMC. The most affected were women of reproductive age attending labour ward. The high prevalence among pregnant women has important reproductive health implications, highlighting the need for routine screening to prevent adverse pregnancy outcomes.

BACKGROUND

Bacterial vaginosis (BV) is the most common vaginal dysbiosis worldwide, affecting an estimated 23–29% of women of reproductive age globally, with prevalence varying by region, sexual behavior, and socioeconomic factors.[1,2] In sub-Saharan Africa, BV prevalence is higher, ranging from 20% to over 50%, reflecting differences in sexual health practices and limited access to reproductive health services.[3] In Tanzania, hospital and community based studies have reported BV prevalence between 20% and 35% among women of reproductive age, highlighting its public health significance.[4] It's known for causing unusual vaginal discharge with a bad smell, while some women experience no symptoms, others might also have burning, pain during urination or sex, and vaginal irritation.[5] Importantly, BV can increase the risk of problems with a woman's reproductive health.[2,6,7] It is caused by disturbance in the vaginal ecosystem, resulting in a reduction of the *Lactobacilli* community and an increase in the diversity of facultative anaerobic bacteria, though to date, the etiology of BV is still unknown.[8,9] BV predominantly occurs in sexually active individuals aged 14 to 49 and is commonly linked to several risk factors, including vaginal douching, multiple sexual partners, recent antibiotic use, and cigarette smoking.[10] The current treatment of BV typically involves an antibiotic, such as Metronidazole and Clindamycin; however, it has been shown that recurrence may occur in up to 80% of women after treatment.[10]

Numerous studies have been conducted to explore the prevalence and associated factors with BV, shedding light on its impact on women's reproductive health. A study done in Dhaka, Bangladesh, among sexually active women with abnormal vaginal discharge reported a prevalence of about 29.2%.[11] Another study done in Portugal reported a prevalence of 3.9% among pregnant women, of which *G. vaginalis* colonization among pregnant women was 67.5%.[12] Also, a study done in the United Kingdom (UK) reported a prevalence of 3.54% among women who visited the antenatal clinic.[13] Moreover, in Turkey, a study reported the prevalence of BV to be 7.76% among Turkish women attending obstetrics and gynecology clinics.[14] In Africa, a study done at St. Paul's Hospital in Ethiopia reported a prevalence of BV to be 48.6% among 210 women enrolled in the study.[15] Also, a study conducted in Nigeria reported a prevalence of 16.6% among pregnant women with abnormal vaginal discharge.[16] Dar es Salaam, a study conducted at Amana Regional Referral Hospital reported a prevalence of 33.2% among non-pregnant women who presented with signs and symptoms of vaginal infection.[17]

Bacterial vaginosis is strongly associated with adverse reproductive and maternal health outcomes, particularly during pregnancy. Several recent systematic reviews and meta-analyses have demonstrated that bacterial vaginosis significantly increases the risk of preterm birth, premature rupture of membranes, and low birth weight, making it a major contributor to maternal and neonatal morbidity worldwide.[18] In addition to adverse pregnancy outcomes, bacterial vaginosis has been associated with pelvic inflammatory disease (PID) and other upper reproductive tract infections that may lead to infertility and chronic pelvic complications if untreated.[19] Furthermore, bacterial vaginosis has been shown to increase susceptibility to sexually transmitted infections (STIs) such as *Chlamydia trachomatis*, *Trichomonas vaginalis*, and other genital infections due to disruption of normal vaginal microbiota and loss of protective lactobacilli.[20] These associations highlight the importance of routine screening, early diagnosis, and effective management of bacterial vaginosis, particularly among pregnant women and women attending reproductive health services, to reduce adverse reproductive outcomes and transmission of infections.[21]

Despite the growing public health importance of bacterial vaginosis, limited research has been conducted to determine its prevalence within the specific setting of Kilimanjaro Christian Medical Centre (KCMC). Few studies have assessed the burden of bacterial vaginosis among women of reproductive age or sexually active women attending this tertiary healthcare facility, creating an important knowledge gap in understanding its local epidemiology. Therefore, this study aimed to address this gap by analysing laboratory data to determine the prevalence of bacterial vaginosis among reproductive-aged women attending KCMC. The findings from this study are expected to provide valuable insights that may support improved diagnosis, management, and reproductive health outcomes among women within this setting and similar healthcare facilities.

MATERIALS AND METHODS

Study design and settings

This was a retrospective laboratory-based study of 891 high vaginal swab (HVS) samples collected from women who attended Kilimanjaro Christian Medical Centre (KCMC) between 1 January 2021 and 30 December 2023. KCMC is a tertiary referral and teaching hospital located in northern Tanzania, serving a population of approximately 15 million people from the Kilimanjaro region and surrounding areas. The hospital has over 500 inpatient beds, more than 1,200 staff, and a large outpatient department that handles over 100,000 visits annually. Its antenatal clinic (ANC) alone attends roughly 15,000 pregnant women each year, making it an important setting for studying reproductive health conditions such as bacterial vaginosis.

Study Population

The study population comprised women aged 14 to 49 years who attended Kilimanjaro Christian Medical Centre (KCMC) between 1 January 2021 and 30 December 2023 and had high vaginal swabs (HVS) collected for bacterial vaginosis examination per physicians' orders.

Eligibility Criteria

Women aged 14 to 49 years who were considered sexually active and had high vaginal swabs (HVS) collected per physicians' orders for bacterial vaginosis examination at KCMC between 1 January 2021 and 30 December 2023 were eligible for inclusion in the study. Women with missing essential information in the hospital database, including ward, age, date of examination, BV status, or identified microorganisms, were excluded. A total of 136 samples were excluded due to incomplete data.

Sampling and Sample Size Calculation

Although this study utilized all eligible high vaginal swab (HVS) samples collected at Kilimanjaro Christian Medical Centre (KCMC) between 1 January 2021 and 30 December 2023, a sample size calculation was conducted during planning to ensure sufficiency for estimating the prevalence of bacterial vaginosis (BV). The minimum sample size for estimating a prevalence in a cross-sectional design is calculated using the standard formula:

$$N = \frac{[Z^2 \times p\ (1-p)]}{e^2}$$

Where *n* is the required sample size,

Z is the standard normal value corresponding to a 95% confidence level (1.96),

P is the estimated prevalence from previous study (p=0.25) [22]

e is the desired precision set at 5% (0.05).

Then,

$N = [1.96^2 \times 0.25 \text{ X } (1-0.25)]/ (0.05^2) = 288$

Therefore, the minimum sample size required to estimate the prevalence of bacterial vaginosis was 288.

Data collection

Relevant patient information, including demographic and

clinical history, was recorded in the hospital's standardized electronic medical system. Women attending various hospital clinics were asked about STI history, including symptoms of bacterial vaginosis (BV) and other STIs. High vaginal swab (HVS) samples were collected from patients meeting testing criteria and sent to the clinical laboratory. BV diagnosis was performed using both Amsel criteria where at least three of the following were required: thin, grayish-white homogenous vaginal discharge; vaginal pH >4.5; presence of clue cells on saline microscopy; and a positive whiff test with 10% KOH and Nugent scoring of Gram-stained vaginal smears (0–3 = normal, 4–6 = intermediate, 7–10 = BV).[23] Results were recorded in the electronic system, from which all data for this study were retrieved.

Statistical Data Analysis

Collected data were retrieved from the standardized electronic medical system and checked for completeness; incomplete records were excluded based on predefined criteria. Cleaned data were imported into SPSS version 27 for analysis. Data consistency and validity were verified, and descriptive statistics were used to summarize participant characteristics in tables and graphs. Associations between bacterial vaginosis (BV) status and independent variables were examined using binary and multivariable logistic regression. Odds ratios (OR) with 95% confidence intervals (CI) were reported, and a *P* value ≤.05 was considered statistically significant.

Ethics Approval

Ethical clearance was sought and obtained from the Kilimanjaro Christian Medical University College (now KCMC University) Research Ethics Review Committee (CRERC) under Protocol No. 2703. Permission to access laboratory records was granted by the Kilimanjaro Christian Medical Centre (KCMC) hospital administration. As this was a retrospective laboratory-based study, patient data were extracted from existing laboratory records without direct contact with participants. All data were handled confidentially, and personal identifiers such as names and registration numbers were removed prior to analysis to ensure anonymity. The collected data were securely stored and accessed only by authorized research personnel.

RESULTS

Demographic and Clinical Characteristics of Study Participants (N=891)

Of the total 891 women whose laboratory records were included in this retrospective study, all were within the reproductive age range (15 to 49 years). The median age of the participants was 27 years (I.Q.R. = 34). The age distribution of the participants showed that the majority, 359 (40.3%), were patients concentrated in the middle reproductive years, specifically in the 25-34 age category. Regarding the clinical departments from which samples originated, the majority of participants, 618 (69.4%), were from the Outpatient Department (OPD). This was followed by the Emergency Medicine Department (EMD), accounting for 131 (14.7%), and the Obstetrics and Gynaecology (OG) clinic with 46 (5.2%) participants. Smaller proportions were from the Dermatology clinic 26 (2.9%) and the Labor Ward 21 (2.4%), while the remaining clinics and wards each contributed less than 1% of the total participants (Table 1).

TABLE 1: Demographic and Clinical Characteristics of Study Participants (N=891)

Variable	Frequency (N)	Percentage (%)
Age category		
15-24	312	35.0
25-34	359	40.3
35-49	220	24.7
Ward/Clinic		
Cardiology	6	0.7
Care and Treatment Clinic (CTC)	1	0.1
Dermatology	26	2.9
Diabetes clinic	3	0.3
Emergency Medicine Department (EMD)	131	14.7
Eye-Nose-Throat department (ENT)	2	0.2
Intensive care unit (ICU)	6	0.7
Labor ward	21	2.4
Medical	15	1.7
Obstetrics & Gynaecology (OG)	46	5.2
Oncology ward	1	0.1
Outpatient Department (OPD)	618	69.4
Orthopedic	7	0.8
Surgical	2	0.2
Urology	6	0.7

Prevalence of Bacterial Vaginosis Among Women of Reproductive Age (N=891).

The overall prevalence of bacterial vaginosis (BV) among the study participants was 324 (36.4%) (Figure 1). The highest prevalence was observed among women aged 25 to 34 years 133 (37.0%%) (Figure 2).

FIGURE 1: Prevalence of Bacterial Vaginosis Among Women of Reproductive Age (N=891)

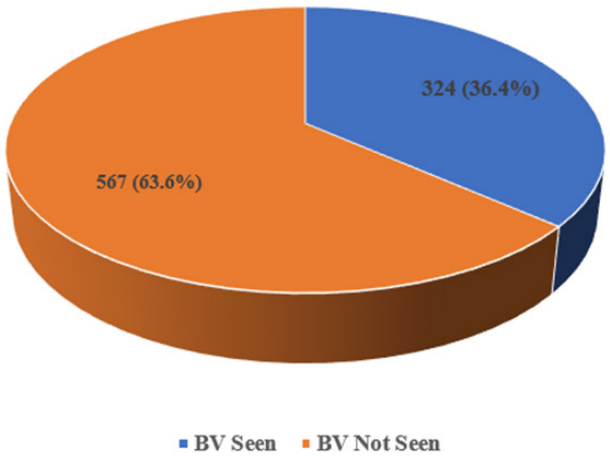
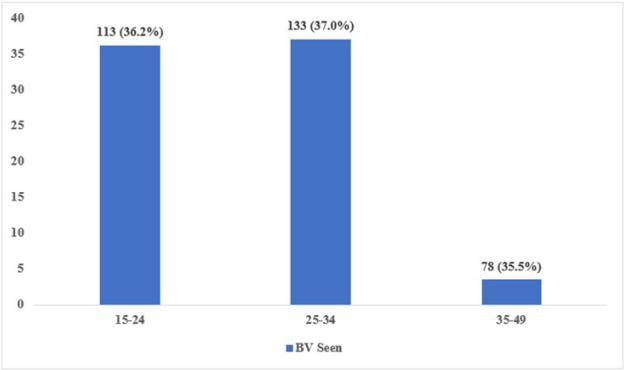


FIGURE 2: Distribution of BV Among Women of Reproductive Age



Distribution of Microorganisms Identified in Vaginal Samples by Age Category

In distributions of microorganisms, laboratory findings, "No Bacteria Growth" was the most common result565 (63.4%).. This finding was most frequent in the 25 to 34 years age group, who account for 223 (25.0%) of all patients.

Among specific microorganisms identified, Fungi were relatively common. *Candida albicans* was the most frequently detected specific organism, confirmed in 205 (23.0%) of all patients. Its presence was observed to be highest in women aged 25 to 34 years, accounting for 88 (9.9%) of all patient samples in that age group, followed by the 15 to 24 years age group, whose proportion was noted to be 76 (8.5%). Other *Candida* species accounted for 20 (2.2%) among patient samples.

Among bacterial isolates, the Gram negative bacterium *Escherichia coli* was the most often isolated, detected in 58 (6.5%) of all samples, with a fairly even distribution across all age categories. Other Gram negative bacteria, such as *Klebsiella pneumoniae* 9 (1.0%) and *Pseudomonas aeruginosa* 5 (0.6%), were found in smaller proportions. Gram positive bacteria, including *Staphylococcus aureus* 7 (0.8%), *Streptococcus* species 7 (0.8%), *Enterococcus* species 2 (0.2%), and *Bacillus* species 1 (0.1%), were identified in very low overall percentages across the studied age groups (Table 2).

Factors Associated With Bacterial Vaginosis Among Women of Reproductive Age

Binary and multivariable logistic regression analyses were performed to assess factors associated with bacterial vaginosis (BV). In the multivariable analysis, presentation at the Labor Ward was identified as a significant protective factor against BV (AOR = 0.096; 95% CI: 0.01–0.78; *P*=.029), indicating significantly lower odds of BV compared to the Cardiology clinic. Additionally, the year of sample collection was significantly associated with BV status. Samples collected in 2022 showed reduced odds of BV (AOR = 0.63; 95% CI: 0.40–0.96; *P*=.03), whereas samples collected in 2023 had significantly higher odds of BV (AOR = 2.24; 95% CI: 1.51–3.32; *P*<.01) compared to those collected in 2021. Age category, clinical departments other than the Labor Ward, and specific microorganisms were not independently associated with BV in the adjusted model (Table 3).

TABLE 2: Distribution of Microorganisms Identified in Vaginal Samples of Women of Reproductive Age (N=891)

Microorganism	Age of Patients (Years) n (%)			
	15-24	25-34	35-49	Total
Gram-Positive Bacteria				
Bacillus species	1 (0.1)	0 (0.0)	0 (0.0)	1 (0.1)
Enterococcus species	0 (0.0)	2 (0.2)	0 (0.0)	2 (0.2)
Staphylococcus aureus	3 (0.3)	4 (0.4)	0 (0.0)	7 (0.8)
Streptococcus species	2 (0.2)	5 (0.6)	0 (0.0)	7 (0.8)
Gram-Negative Bacteria				
Acinetobacter baumannii	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)
Acinetobacter species	1 (0.1)	1 (0.1)	1 (0.1)	3 (0.3)
Citrobacter freundii	1 (0.1)	2 (0.2)	0 (0.0)	3 (0.3)
Citrobacter koserii	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)
Citrobacter species	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.1)
Enterobacter aerogenes	1 (0.1)	0 (0.0)	0 (0.0)	1 (0.1)
Escherichia coli	23 (2.6)	19 (2.1)	16 (1.8)	58 (6.5)
Klebsiella oxytoca (or ox-ca)	0 (0.0)	1 (0.1)	1 (0.1)	2 (0.2)
Klebsiella pneumoniae	4 (0.4)	5 (0.6)	0 (0.0)	9 (1.0)
Pseudomonas aeruginosa	0 (0.0)	3 (0.3)	2 (0.2)	5 (0.6)
Fungus				
Candida albicans	76 (8.5)	88 (9.9)	41 (4.6)	205 (23.0)
Candida species	14 (1.6)	5 (0.6)	1 (0.1)	20 (2.2)
No Bacterial Growth	186 (20.9)	223 (25.0)	156 (17.5)	565 (63.4)

TABLE 3: Factors Associated with Bacterial Vaginosis Among Women of Reproductive Age

Variable	BV status		COR (95% CI)	*P value*	AOR (95% CI)	*P value*
	Positive N (%)	Negative N (%)				
Age category						
15-24	113 (34.9)	199 (35.1)	1			
25-34	133 (41.0)	226 (39.9)	1.03(0.57 - 1.42)	.82		
35-49	78 (24.1)	142 (25.0)	0.97(0.68 - 1.39)	.86		
Ward/Clinic						
Cardiology	4 (1.2)	2 (0.4)	1			
Care and Treatment Clinic (CTC)	0 (0.0)	1 (0.3)	0.000 (-)	1.000	0.000 (-)	1.00
Dermatology	8 (2.5)	18 (3.2)	0.22 (0.03 - 1.47)	.03*	0.20 (0.03-1.53)	.12
Diabetic clinic	1 (0.3)	2 (0.4)	0.25 (0.13 - 4.73)	.36	0.28 (0.01-6.88)	.43
Emergency Medicine Department (EMD)	42 (13.0)	89 (15.7)	0.24 (0.42-1.34)	.04*	0.19 (0.03-1.19)	.08
Eye-Nose-Throat department (ENT)	0 (0.0)	2 (0.4)	0.000 (-)	.99	0.000	.99
Intensive care unit (ICU)	0 (0.0)	6 (1.1)	0.000 (-)	.99	0.000	.99
Labor ward	6 (1.9)	15 (2.6)	0.200 (0.03-1.39)	.01*	0.096 (0.01-0.78)	.029*
MEDICAL	4 (1.2)	11 (1.9)	0.18 (0.23 -1.40)	.103	0.19 (0.02-1.70)	.140
Obstetrics & Gynaecology (OG)	15 (4.6)	31 (5.5)	0.24 (0.40-1.47)	.124	0.25 (0.04-1.74)	.161
Oncology	0 (0.0)	1 (0.2)	0.000 (-)	1.000	0.000	.999
Outpatient Department (OPD)	238 (73.5)	380 (67.0)	0.31 (0.06-1.72)	.01*	0.25 (0.04-1.54)	.134
Orthopedic	4 (1.2)	3 (0.5)	0.68 (0.06-6.40)	.73	0.73 (0.06-8.23)	.797
Surgical	1 (0.3)	1 (0.2)	0.50 (0.02-12.89)	.68	0.67 (0.02-20.28)	.820
Urology	1 (0.3)	5 (0.9)	0.10 (0.006-1.54)	.99	0.08 (0.005-1.48)	.091
Microorganism						
Acinetobacter baumanii	2 (0.6)	1 (0.2)	1		1	
Acinetobacter species	0 (0.0)	1 (0.2)	-			
Bacillus species	1 (0.3)	0 (0.0)	-	1.000	-	-
Candida albicans	88 (27.2)	117 (20.6)	0.73 (0.10-5.28)	.76	0.67 (0.08-5.39)	.71
Candida species	7 (2.2)	13 (2.3)	0.73 (0.10-5.28)	.76	0.67 (0.08-5.39)	.71
Citrobacter freundii	3 (0.9)	0 (0.0)	4.00 (0.21-75.66)	.36	-	.99
Citrobacter koserii	1 (0.3)	0 (0.0)	4.00 (0.21-75.66)	.36	-	-
Citrobacter species	0 (0.0)	1 (0.2)	4.000(0.21-75.65)	.36	-	-
Enterobacter aerogenes	0 (0.0)	1 (0.2)	0.00	1.00	0.00	1.00
Enterococcus species	0 (0.0)	2 (0.4)	0.00	.99	0.00	.99
Escherichia coli	36 (11.1)	22 (3.9)	1.64 (0.22-12.47)	.64	1.67 (0.19-14.28)	.63
Klebsiella ox-ca	0 (0.0)	2 (0.4)	1.20 (0.12-11.13)	.87	1.63 (0.14-18.99)	.69
Klebsiella pneumoniae	6 (1.9)	3 (0.5)	1.20 (0.12-11.13)	.87	-	-
No bacterial growth	172 (53.1)	393 (69.3)	0.43 (0.06-3.13)	.41	0.35 (0.04-2.84)	.33
Pseudomonas aeruginosa	4 (1.2)	1 (0.2)	4.00 (0.21-75.65)	.35	2.88 (0.13-61.09)	.49
Staphylococcus aureus	1 (0.3)	6 (1.1)	0.16 (0.009-2.98)	.02*	0.24 (0.01-4.79)	.35
Streptococcus species	3 (0.9)	4 (0.7)	0.75 (0.44-8.83)	.81	0.45 (0.03-6.074)	.554
Year						
2021	57 (17.6)	130 (22.9)	1			
2022	67 (20.7)	214 (37.7)	0.71 (0.472- 1.08)	.01*	0.63 (0.40-0.96)	.03*
2023	200 (61.7)	223 (39.3)	2.04 (1.42 - 2.94)	<.001 *	2.24 (1.51-3.32)	<.01*

COR = crude odds ratio; AOR = adjusted odds ratio, Bolded=significant, $p<.05$

DISCUSSION

The present study demonstrated a relatively high prevalence of bacterial vaginosis among women of reproductive age attending a tertiary hospital in northern Tanzania. This finding is consistent with reports from sub-Saharan Africa, where bacterial vaginosis remains a common vaginal condition affecting women of reproductive age. Similar prevalence levels have been reported in studies conducted in Tanzania and other African countries, highlighting the persistent burden of bacterial vaginosis in the region.[24] In contrast, lower prevalence rates have been reported in regions such as Asia, Europe, and North America, reflecting differences in socio-economic status, hygiene practices, and access to reproductive health services.[25,26] Our study revealed an overall BV prevalence of 36.4% at KCMC. Current prevalence is higher compared with the global prevalence[1] However, prevelance reported in this study is lower compared to 42.1% reported in a meta-analysis performed by Torrone et al.[25]Compared with some developed countries, the prevalence reported in this study is higher than 3.9%, 3.54%, and 7.76% reported in Portugal, the UK, and Turkey, respectively.[13,14,27] Higher prevalence rates were reported in other sub-Saharan African countries, such as Ethiopia (48.6%), Gambia (46.6%), Botswana (38%), and Kenya (37%).[28–30] Lower prevalence rates were also reported in the same African region in Zimbabwe (32.5%) and Nigeria (16.6%),[31,32] while local studies reported prevalence of 26.7%, 28.5% and 33.2%.[17,33,34]

In the current study, the prevalence of BV was highest observed in sexually active women aged 25 to 34, with 37.0%. Highest prevalence was also reported in Nepal (60.16% and 8.8%), Nigeria (35.8%), and Ethiopia (47.8%). Both studies included patients with almost the same age categories as our present study.[29,35–37] The highest prevalence of this age group, 25 to 34, may be due to the high sexual exposure and reproductive activity of this age group. Generally, these notable variations highlighted from these different studies may be due to potential differences in the study populations, including symptomatic vs. general population, pregnant vs. non-pregnant women diagnostic criteria, or actual epidemiological disparities across regions and clinical settings. The higher prevalence at KCMC compared to other Tanzanian sites underscores that BV is still a significant public health concern in Northern Tanzania.

The trend in BV prevalence was a significant finding. We observed a decrease in BV odds in 2022 compared to 2021, followed by a significant increase in 2023. Such fluctuations could be influenced by various factors. Changes in healthcare seeking behaviours, access to services, or even antibiotic prescription patterns in the post-COVID-19 pandemic era could play a role. Continuous surveillance is essential to understand if this upward trend in 2023 persists and to identify underlying drivers.

BV situation is highly associated with disturbance in the vaginal ecosystem, resulting in reduction of the *Lactobacilli* community and an increase in the diversity of facultative anaerobic bacteria, primarily G. vaginalis and *Mobiluncus spp*. and other bacteria (*Escherichia coli*, *Klebsiella spp*., *Acinetobacter spp*., *Staphylococcus spp*., *enterococci*, *and Streptococcus spp*).[38–41] In the present study, vaginal swabs were cultured, and a total of 101 isolates of gram-positive and gram-negative bacteria, with 225 fungal isolates, were recovered. These recovered isolates were likely more or less diverse than the ones found in different studies from Ethiopia, Poland, and India[29,42–44] which drives a need for more studies to elucidate the BV association with aerobic vaginitis, as previously suggested.[29]

In current findings presence of microorganisms was found to be associated with BV status. *Escherichia coli*, gram-negative bacteria, were predominantly among cultured bacteria isolates, with 11.1%. High observatory of this bacterium suggests the outcome of BV status, as it has been noted that its high prevalence can colonize the vagina and lead to the replacement of natural microflora, by eliminating lactobacilli, which may result in BV.[43] Although presented in very low proportion, among gram-positive bacteria, *Staphylococcus aureus* and *Streptococcus spp*., with 1.2% of total bacterial incidence associated with BV present. This is consistence with findings from Nepal, Pakistan, India, and Iraq.[35,45–48] Association of BV and these bacteria may be due disruption of the normal vaginal environment through colonization of vaginal mucosa and during immunity deprivation.[49,50] Prevalence of Candida albicans, a fungus isolate, was found to be 27.2% among BV-positive cases. In other settings, this fungus was found to be associated with women having infections of the lower genital tract, including BV.[43] As it was previously noted, the association of vaginal infections and *Candida spp*. may lead to immune dysfunction, favoring the promotion and progression of a lot of health complications in women.[43] Although most of the cultured isolates (63.4%) were found to have no bacterial growth, this highlights the need to not only rely on culture-based methods for BV diagnosis, as mostly bacteria also anaerobic bacteria involved in BV, are often fastidious, as noted in a previous report.[51]

Limitations and Strengths of the Study

This study had several limitations. First, the retrospective design relied on existing laboratory records, which limited the availability of important clinical and behavioral variables such as sexual practices, antibiotic use, hygiene practices, and pregnancy outcomes that may influence bacterial vaginosis. Second, some records were excluded due to incomplete information, which may have introduced selection bias. Third, the study was conducted at a single tertiary referral hospital, which may limit the generalizability of the findings to other healthcare settings. Despite these limitations, this study had notable strengths, including the relatively large sample size of 891 participants, which improved the statistical power and reliability of the findings. Additionally, the use of standardized diagnostic methods, including both Amsel criteria and Nugent scoring, enhanced the accuracy of bacterial vaginosis diagnosis. Furthermore, the use of standardized electronic medical records improved data consistency and minimized transcription errors.

CONCLUSION

The findings of this study underscore the importance of ongoing surveillance for BV and integrating comprehensive sexual and reproductive health education

and services within hospital settings. Future prospective studies are recommended to collect detailed clinical, behavioural, and molecular microbiological data to identify more precise risk factors and to understand the dynamics of BV aetiology in this population.

REFERENCE

1. Peebles, K., Velloza, J., Balkus, J. E., McClelland, R. S. & Barnabas, R. V. High Global Burden and Costs of Bacterial Vaginosis: A Systematic Review and Meta-Analysis. Sex. Transm. Dis. 46, 304–311 (2019).
2. Turovskiy, Y., Sutyak Noll, K. & Chikindas, M. L. The aetiology of bacterial vaginosis. J. Appl. Microbiol. 110, 1105–1128 (2011).
3. Sethi, N. et al. Prevalence, risk factors, and adverse outcomes of bacterial vaginosis among pregnant women: a systematic review. BMC Pregnancy Childbirth 25, 40 (2025).
4. Shayo, P. A. et al. Prevalence of bacterial vaginosis and associated factors among pregnant women attending at Bugando Medical Centre, Mwanza, Tanzania. Tanzan. J. Health Res. 14, (2012).
5. Bilardi, J. E. et al. The Burden of Bacterial Vaginosis: Women's Experience of the Physical, Emotional, Sexual and Social Impact of Living with Recurrent Bacterial Vaginosis. PLoS One 8, e74378 (2013).
6. Chen, X., Lu, Y., Chen, T. & Li, R. The Female Vaginal Microbiome in Health and Bacterial Vaginosis. Front. Cell. Infect. Microbiol. 11, (2021).
7. Ravel, J., Moreno, I. & Simón, C. Bacterial vaginosis and its association with infertility, endometritis, and pelvic inflammatory disease. Am. J. Obstet. Gynecol. 224, 251–257 (2021).
8. Marrazzo, J. M. et al. Bacterial Vaginosis: Identifying Research Gaps Proceedings of a Workshop Sponsored by DHHS/NIH/NIAID. Sex. Transm. Dis. 37, 732–744 (2010).
9. Hill, G. B. The microbiology of bacterial vaginosis. Am. J. Obstet. Gynecol. 169, 450–4 (1993).
10. Kairys, N., Carlson, K. & Garg, M. Bacterial Vaginosis. (2024).
11. Yusuf, M. A. et al. Common microbial aetiology of abnormal vaginal discharge among sexually active women in Dhaka, Bangladesh. South East Asia Journal of Public Health 1, 35–39 (2013).
12. Machado, D., Castro, J., Martinez-de-Oliveira, J., Nogueira-Silva, C. & Cerca, N. Prevalence of bacterial vaginosis in Portuguese pregnant women and vaginal colonization by Gardnerella vaginalis. PeerJ 5, e3750 (2017).
13. Akinbiyi, A. A., Watson, R. & Feyi-Waboso, P. Prevalence of Candida albicans and bacterial vaginosis in asymptomatic pregnant women in South Yorkshire, United Kingdom. Arch. Gynecol. Obstet. 278, 463–466 (2008).
14. Haltas, H., Bayrak, R. & Yenidunya, S. To determine of the prevalence of Bacterial Vaginosis, Candida sp, mixed infections (Bacterial Vaginosis + Candida sp), Trichomonas Vaginalis, Actinomyces sp in Turkish women from Ankara, Turkey. Ginekol. Pol. 83, 744–8 (2012).
15. Bitew, A., Abebaw, Y., Bekele, D. & Mihret, A. Prevalence of Bacterial Vaginosis and Associated Risk Factors among Women Complaining of Genital Tract Infection. Int. J. Microbiol. 2017, 1–8 (2017).
16. Aduloju, O. P., Akintayo, A. A. & Aduloju, T. Prevalence of bacterial vaginosis in pregnancy in a tertiary health institution, south western Nigeria. Pan African Medical Journal 33, (2019).
17. V Majigo, M., Kashindye, P., Mtulo, Z. & Joachim, A. Bacterial vaginosis, the leading cause of genital discharge among women presenting with vaginal infection in Dar es Salaam, Tanzania. Afr. Health Sci. 21, 531–537 (2021).
18. Hadhoum, S. et al. Reassessing the association between bacterial vaginosis and preterm birth: A systematic review and meta-analysis. J. Gynecol. Obstet. Hum. Reprod. 54, 102871 (2025).
19. Swidsinski, S., Moll, W. M. & Swidsinski, A. Bacterial Vaginosis-Vaginal Polymicrobial Biofilms and Dysbiosis. Dtsch. Arztebl. Int. 120, 347–354 (2023).
20. Klein, R. D. & Hultgren, S. J. Urinary tract infections: microbial pathogenesis, host–pathogen interactions and new treatment strategies. Nat. Rev. Microbiol. 18, 211–226 (2020).
21. Nyemba, D. C. et al. Prevalence of curable sexually transmitted infections and bacterial vaginosis during pregnancy in sub-Saharan Africa: A systematic review and meta-analysis. Sex. Transm. Infect. 98, 484 (2021).
22. Francis, S. C. et al. Prevalence of sexually transmitted infections among young people in South Africa: A nested survey in a health and demographic surveillance site. PLoS Med. 15, e1002512 (2018).
23. Amsel, R. et al. Nonspecific vaginitis. Am. J. Med. 74, 14–22 (1983).
24. Redelinghuys, M. J., Geldenhuys, J., Jung, H. & Kock, M. M. Bacterial Vaginosis: Current Diagnostic Avenues and Future Opportunities. Front. Cell. Infect. Microbiol. 10, (2020).
25. Torrone, E. A. et al. Prevalence of sexually transmitted infections and bacterial vaginosis among women in sub-Saharan Africa: An individual participant data meta-analysis of 18 HIV prevention studies. PLoS Med. 15, e1002511 (2018).
26. Tesfay, G., Deekonda, K., Paramasivam, R. & Muthupandian, S. Prevalence And Associated Risk Factors Of Bacterial Vaginosis Among Pregnant Women In Africa: A Systematic Review. Preprint at https://doi.org/10.21203/rs.3.rs-23000/v1 (2020).
27. Machado, D., Castro, J., Martinez-de-Oliveira, J., Nogueira-Silva, C. & Cerca, N. Prevalence of bacterial vaginosis in Portuguese pregnant women and vaginal colonization by Gardnerella vaginalis. PeerJ 5, e3750 (2017).
28. Demba, E. et al. Bacterial vaginosis, vaginal flora patterns and vaginal hygiene practices in patients presenting with vaginal discharge syndrome in The Gambia, West Africa. BMC Infect. Dis. 5, 12 (2005).
29. Bitew, A., Abebaw, Y., Bekele, D. & Mihret, A. Prevalence of Bacterial Vaginosis and Associated Risk Factors among Women Complaining of Genital Tract Infection. Int. J. Microbiol. 2017, 1–8 (2017).
30. Marx, G. et al. Diagnosis of sexually transmitted infections and bacterial vaginosis among HIV-1-infected pregnant women in Nairobi. Int. J. STD AIDS 21, 549–552 (2010).
31. Aduloju, O. P., Akintayo, A. A. & Aduloju, T. Prevalence of bacterial vaginosis in pregnancy in a tertiary health institution, south western Nigeria. Pan African Medical Journal 33, (2019).

32. Kurewa, N. E. et al. The burden and risk factors of Sexually Transmitted Infections and Reproductive Tract Infections among pregnant women in Zimbabwe. BMC Infect. Dis. 10, 127 (2010).

33. F. Shaffi, A., Balandya, B., Majigo, M. & Aboud, S. Predictors of Bacterial Vaginosis among Pregnant Women Attending Antenatal Clinic at Tertiary Care Hospital in Tanzania: A Cross Sectional Study. East African Health Research Journal 5, 59–68 (2021).

34. Shayo, P. A. et al. Prevalence of bacterial vaginosis and associated factors among pregnant women attending at Bugando Medical Centre, Mwanza, Tanzania. Tanzan. J. Health Res. 14, (2012).

35. Ranjit, E., Raghubanshi, B. R., Maskey, S. & Parajuli, P. Prevalence of Bacterial Vaginosis and Its Association with Risk Factors among Nonpregnant Women: A Hospital Based Study. Int. J. Microbiol. 2018, 1–9 (2018).

36. Garba, D. J. Microbiological Diagnosis of Bacterial Vaginosis in Pregnant Women in a Resource Limited Setting in North Central Nigeria. American Journal of Life Sciences 2, 356 (2014).

37. Ravi Shankar Gupta, Dipak Bhargav and Jagat Prasad Deep. Common Types of Vaginitis (Bacterial Vaginosis, Vulvovaginal Candidiasis, Trichomoniasis) and their Association with Urinary Tract Infection among Women Visiting NMCTH, Birgunj. Int.J.Curr.Microbiol.App.Sci (2021) 10(01): 996-1010 https://doi.org/10.20546/ijcmas.2021.1001.121

38. Marrazzo, J. M. et al. Bacterial Vaginosis: Identifying Research Gaps Proceedings of a Workshop Sponsored by DHHS/NIH/NIAID. Sex. Transm. Dis. 37, 732–744 (2010).

39. Hill, G. B. The microbiology of bacterial vaginosis. Am. J. Obstet. Gynecol. 169, 450–4 (1993).

40. McDonald, H. M., O'Loughlin, J. A., Jolley, P. T., Vigneswaran, R. & McDonald, P. J. Changes In Vaginal Flora During Pregnancy And Association With Preterm Birth. Journal of Infectious Diseases 170, 724–728 (1994).

41. Hay, P. E. et al. Abnormal bacterial colonisation of the genital tract and subsequent preterm delivery and late miscarriage. BMJ 308, 295–298 (1994).

42. Mulu, W., Yimer, M., Zenebe, Y. & Abera, B. Common causes of vaginal infections and antibiotic susceptibility of aerobic bacterial isolates in women of reproductive age attending at Felegehiwot referral Hospital, Ethiopia: a cross sectional study. BMC Womens Health 15, 42 (2015).

43. Wójkowska-Mach, J., Pomorska-Wesołowska, M., Romanik, M. & Romaniszyn, D. Prevalence and Antimicrobial Susceptibility Profiles of Microorganisms Associated with Lower Reproductive Tract Infections in Women from Southern Poland—Retrospective Laboratory-Based Study. Int. J. Environ. Res. Public Health 18, 335 (2021).

44. Lakshmi, K., Aishwarya, J., Chitralekha, S. & Menezes, G. Review on infectious vaginitis. https://doi.org/10.5555/20133312144(2013) doi:10.5555/20133312144.

45. Maghsoudi, R., Danesh, A., Kabiri, N., Setorki, M. & Doudi, M. Prevalence of the Genital Tract Bacterial Infections after Vaginal Reconstructive Surgery. Pakistan Journal of Biological Sciences 17, 1058–1063 (2014).

46. Tivvagura, S., Taranikanti, M., Ala, S. & Mathur, D. R. BACTERIAL VAGINOSIS IN INDIAN WOMEN IN THE REPRODUCTIVE AGE GROUP. Int. J. Biomed. Res. 3, (2012).

47. Masood, S. N. , M. S. E. E. M. A. , &J. M. Pattern of normal vaginal flora in healthy married non-pregnant women. https://scholar.google.com/scholar_lookup?journal=Pakistan%20Journal%20Of%20Surgery&title=Pattern%20of%20normal%20flora%20in%20healthy%20married%20non%20-pregnant%20women&author=S.%20N.%20Masood&author=S.%20Mumtaz&author=M.%20Jahan&volume=25&issue=2&publication_year=2009&pages=128-131& (2009).

48. Al-Mousawi, J. K. N., Tarish, H. R. & Al-Saadi, M. M. K. Microbiological study of Bacterial vaginosis among pregnant women in Al-Diwaniya city. pdfs.semanticscholar.orgJKN Al-Mousawi, HR Tarish, MMK Al-SaadiThe Medical Journal of Basrah University, 2006•pdfs.semanticscholar.org https://pdfs.semanticscholar.org/d701/05aa3ddf5444e926ec983c2af6237bde6f8e.pdf (2006).

49. Achdiat, P., Saraswati, A. L., Handayani, Y., Rowawi, R. & Maharani, R. Aerobic Vaginitis Caused By Streptococcus &Bgr;- Hemolyticus and Staphylococcus Epidermidis in a 26-Year-Old Woman with a History of Frequent Antibiotics Administration. Int. J. Womens Health Volume 17, 1437–1444 (2025).

50. Maduta, C. S., Tuffs, S. W., McCormick, J. K. & Dufresne, K. Interplay between Staphylococcus aureus and the vaginal microbiota. Trends Microbiol. 32, 228–230 (2024).

51. Coleman, J. S. & Gaydos, C. A. Molecular Diagnosis of Bacterial Vaginosis: an Update. J. Clin. Microbiol. 56, (2018).

Peer Reviewed

Acknowledgments: We acknowledge the KCMC hospital administration for granting permission to conduct this study and for facilitating access to their comprehensive electronic medical records. Also, we acknowledge the KCMC clinical laboratory staff for their support during the collection, processing, and accurate documentation of patient data, which was fundamental to the successful execution and findings of this research.

Competing Interests: The authors declare no competing interests.

Funding: The study did not receive any funding.

Received: 23 Jan 2025; **Accepted:** 28 March 2026

Cite this article as Gamuya BE, Issangya TE, Mwakyoma A, Maguga EI, Manyata S, Kajeguka CD, Mnzava D. Prevalence and Microbial Distribution of Bacterial Vaginosis Among Women of Reproductive Age at Kilimanjaro Christian Medical Centre: A Three-Year Retrospective Laboratory Based Study. *East Afr Science J.* 2026: 8(1): 12-19. https://doi.org/10.24248/easci.v8i1.130