Original Research Article

Bacterial Vaginosis Prevalence and its associated risk factors among women at Kiambu level-5 Hospital, Kenya

ABSTRACT

Background: Bacterial vaginosis (BV) is acommonly experienced vaginal disorder in women. It occurs when the beneficial lactobacillus species are replaced by anaerobic and facultative bacteria, leading to a foul-smelling vaginal discharge. Its diagnosis remains a big challenge in developing countries such as Kenya. Gram stain and Nugent scoring of the bacterial morphotypes is the recommended method of diagnosis, but is tedious to undertake and require highly skilled microscopists.

Objective: The study's objectiveiswas todetermine the prevalence of BV among women at Kiambu Level-5 Hospital and to ascertain the risk factors associated with it.

Study Design: Tt is aThecCross-sectional analytic study thatwas carried out at Kiambu Level-5 hospital, department of Pathology between April 2023 and June 2023.

Methodology: AWe included196 women were included, their age ranged from between the ages 18-55. Theywhowere enrolled by convenience samplingand screened for bacterial vaginosis using gram staining andmicroscopy for bacterial morphotypes.

Results: Out of the 196 participants, 46(23%) were positive for BV, (77%) (23%), 150were nNegative (77%) for BV by by the gram stain method.Twenty three (%) 23 of them had yeast cells (candidiasis), 21(%)had pus cells and only 1 participant had gonococci (%). Out of the risk factors analysed, only age had a significant association with BV at a confidence intervalof P=.03

Conclusion: Bacterial vaginosis infection was more prevalent in women the age group of 41-45 years old.There is a significant positive association between age and BV infection.Age was found to have a statistically significant association with BV.

Key words*: Bacterial vaginosis, Nugent scoring, Vaginal discharge, anaerobic and facultative.*

INTRODUCTION

Bacterial vaginosis is the most common vaginal infection experienced by women all over the world. It is frequently encountered in sSexually tTransmitted dDiseases clinics, out-patient departments and reproductive health clinics. with Aabout 5-70 % of women were affected [1]. It occurs when there is replacement of the beneficial lactobacillus that usually regulates the vaginal PH, making it acidic, by

production of hydrogen peroxide that is vital in preventing anaerobic microbes in the vagina from growing extremely [2]. Absence of lactobacillus causes PH increase within the vagina. This leads to increased population of non-pathogenic bacteria such as*Atopobiumvaginae**Gardnerella vaginalis*, *Mycoplasma hominis*and*Ureaplasmaurealyticum,* among other bacteria, leading to a foul-smelling vaginal discharge. [3,4].

Burden of Bacterial vaginosis is greater in Sub-Saharan region with a~~at 38%~~ prevalence of 38% and 55 % according to a studies were done by Jespersand his group~~*et al.*~~,[5], and ~~at 55 % as found by~~ Woodman respectively,[6]. The prevalence in Kenya varies among various studies in diverse areas of the country. For instance, Mutuku *et a*l., ~~[7]~~conducted a study among H.I.V(write the whole wards) infected women in Machakos county that had a prevalence rate of 10.3%[7], while a study~~another~~ by Musyoki*et al.,*~~[8]~~that was done among~~st~~ female commercial sex workers in Nairobi had prevalence of 15.1 %[8]. A study by ~~while~~ Nzomo*et al.,*~~[9]~~showed a prevalence of ~~found~~ 43 % ~~in a study conducted~~ in Thika[9]. Regardless of the variation in prevalence rates across the country, BV exhibits~~remains~~ a major concern in public health and research. Several factors are linked to its occurrence such as contraceptive IUCD (write the whole ward) use, having many sex partners, new sex partner, intravaginal cleaning and unprotected sex [ref]. The symptoms of BV include; itchiness, sore and painful vagina, a discharge that is thin, white, grey or greenish in colour with a 'fishy 'odour[10]. However, many women with bacterial vaginosis experience no symptoms, which further complicates the diagnosis and management of cases [11].

Centers for Disease Control (CDC) recommends that clinical bacterial vaginosis screening should be done through the Amsel's criteria [ref]. This involves checking the PH of the vaginal discharge which is usually more than 4.5 in the presence of BV, examining a wet preparation for clue cells and noticing an amine-like smell after adding 10% potassium hydroxide to the vaginal discharge. The other method is through gram staining the vaginal discharge, as the gold standard method and determining the population of lactobacilli*, Gadnerellavaginalis*, *bacteroides* and *mobilincu*s species which are linked to BV[12]. Even though gram staining and Nugent scoring is the gold standard for screening BV, it takes a lot of time to accomplish and requires an expert in microscopy[ref].

The modified Amsel's criteria reliesy on two features only to screen for bacterial vaginosis with a couple of studies proving this to be sensitive, less cumbersome and relatively fast [13]. Presence of clue cells on a wet preparation of the discharge and PH more than 4.5 have been shown to have a good match with Nugent score as found in studies by [14,15]. Screening of BV still remains complicated due to the fact that it is attributed to host, social, epidemiologic and biological influences [16,17]

MATERIALS AND METHODS

Study Design

We conducted a cross-sectionalstudy at Kiambu level-5 hospital comprehensive care centre between April and June 2023. High Vaginal Swab specimen were collected from 196 participants and analysed for BV.

Inclusion Criteria

Females aged between 18-55 years old attending CCC (write the whole wards) clinic at Kiambu level-5 hospital who agreed to be involved in the research, and signed a consent form was taken from them.,were enrolled into the study.

Exclusion Criteria

Pregnant women and those on their periods as well as those who declined to give a signed consent did not take part in the research.(what about those using IUCD, multiple sex partners, HIV, diabetic women, those with chronic immune suppressive treatment or with immune suppression diseases?are they excluded?please discuss the excluded females in details.

Laboratory Methods

Collection of High Vaginal Swabs

With the patient lying on a couch, legs apart, a speculum examination was done by the nurse and the vagina scrutinised for discharge, abrasions and erythema. A sterile high vaginal swab was labelled and used to obtainspecimen from the posterior fornix of the vagina. This was transported at an appropriate temperature to the laboratory where it was smeared onto a clean- labelled slide, by rolling the swab over

a drop of normal saline and allowing to air dry. The smear was then heat-fixed by passing the slide three times over a burner flame. This was followed by staining with the Gram ‘s technique after which it was examined microscopically using X100 magnification for clue cells, Lactobacillus species and coccobacilli that are gram-variable. These were scored as per the Nugent score. [19].

All positive BV results and any other infections detectedwere communicated to the nurse at the clinic for patient follow-up and treatment.

Quality Control

All procedures were performed by strictly adhering to the Standard Operating Procedures. Positive and negative control smears were stained together with the patient samples to validate the quality of the stains.

Data Collection, Analysis and Presentation

A questionnaire with both open and closed ends was used to capture the demographic details of the participants.This data together with the obtained results were entered into excel spreadsheet (write in details the contents of the questionnaire).

The data wereas imported from Excel into the SPSS version 26and analysis for the dependent and independent variableswere done. Nominal and categorical variables were also analysed and presented as tables and charts. The results were expressed as percentages. P-value less than 0.05 was considered statistically significant at a confidence interval of 95%. Chi-square test was also used in the comparison of categorical and nominal data.

RESULTS

A total of 196 women were tested for Bacterial Vaginosis. Their mean age was 40.18 ± and the Standard Deviation 8.59. Majority were from the age group 46-50 years old (28.6%), while the age group 18-20 years had only one participant tested positive for BV (0.5%) (Table 1)

The highest prevalence of BV was recorded among the age group 41-45 years n=15 (32.6%) followed by the age group 36-40 years n=10(21.7%). It was noted that those aged 51-55 years old had the lowest incidence of BV n=1 (2.2%) and age had a statistical association with BV (P=.03).

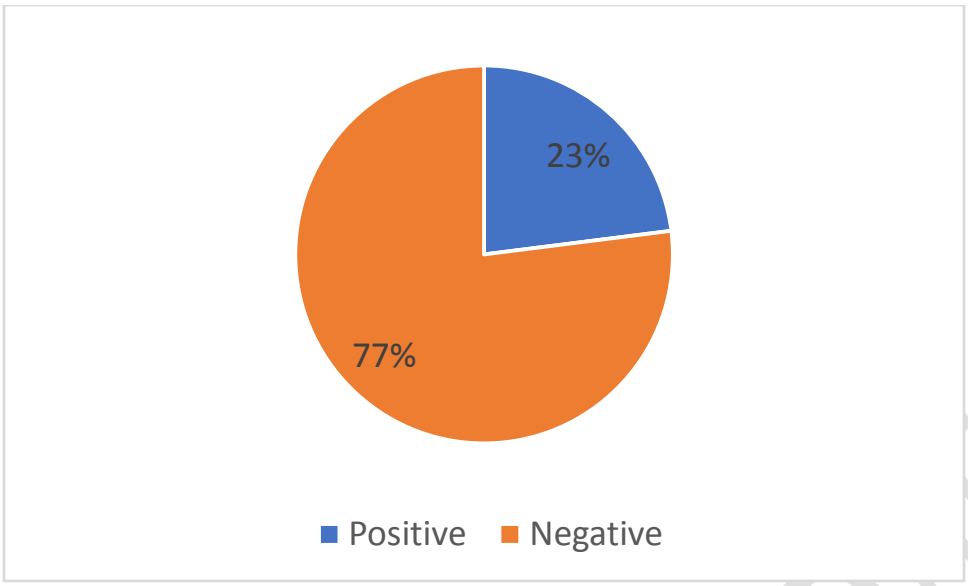
The overall prevalence of BV in this study was 46/196 (23%)while150/196 patients (77%) were negative for Bacterial Vaginosis with Nugent scores of 0-3(Pie chart 1)

This study revealed that BV was more prevalent among the married women at 56.5% and lowest among the widowed and divorced at 2.2% and 4.3% respectively.(Table 2)

Out of all the risk factors analysed, only age had a statistically significant association with BV. The others such as marital status, level of education and family planning method had no significant statistical association ~~statistically~~.

The study also detected candidiasis, pus cells and gonococci among the participants at 23/196 (51.1%), 21/196 (46.6%) and 1/196 (2.2%) respectively (Table 3).

~~**Pie chart 1:Prevalence of Bacterial vaginosis**~~



Pie chart 1:Prevalence of Bacterial V~~v~~aginosis(the title of the figure should be wrote at the bottom)

Table 1: Comparison ~~of age and~~ Bacterial V~~v~~aginosis Infection Among different age groups.

	Bacterial Vaginosis			
Age (years)	Total number (%)	Positive number (%)	Negative number (%)	*P-value*
18-20	1(0.5)	0(0.0)	1 (0.7)	0.030
21-25	12 (6.1)	6 (13.0)	6(4.0)	
26-30	23(11.7)	5(10.9)	18 (12.0)	
31-35	20 (10.2)	2 (4.3)	18(12.0)	
36-40	38 (19.4)	10(21.8)	28(18.6)	
41-45	40(20.4)	15(32.6)	25(16.7)	
46-50	56(28.6)	7(15.2)	49(32.7)	
51-55	6(3.1)	1(2.2	5(3.3)	
Total number	196(100)	46(100)	150(100)	

Table 2: Comparison of Marital status, Education, Family planning among~~and~~ Bacterial Vaginosis C~~c~~ases

	Bacterial Vaginosis			
Marital Status	Total number (%)	Positive number (%)	Negative number (%)	*P-value*
Single	75 (38.3)	17 (37.0)	58(38.7)	0.427
Married	112 (57.1)	26 (56.5)	86 (57.3)	
Divorced	3 (1.5)	2 (4.3)	1 (0.7)	
Widowed	6(3.1)	1(2.2)	5(3.3)	
Total number	196(100.0)	46 (100.0)	150 (100.0)	
Education	Total number (%)	Positive number (%)	Negative number (%)	0.149
None	4 (2.0)	1 (2.2)	3(2.0)	
Primary	88 (44.9)	20(43.5)	68(45.3)	
secondary	74 (37.8)	16(34.7)	58(38.7)	
College	30 (15.3)	9(19.6)	21(14.0)	
Total number	196(100.0)	46 (100.0)	150(100.0)	
Family Planning Method	Total number (%)	Positive number (%)	Negative number (%)	
None	137(69.9)	33(71.8)	104(69.3)	0.111
Pills	19 (9.7)	3(6.5)	16(10.8)	
Coil	2(1.0)	2(4.3)	0(0.0)	
Implant	11 (5.6)	4 (8.7)	7 (4.7)	
Condom	8(4.1)	0 (0.0)	8(5.3)	
Injection	10 (5.1)	2(4.3)	8 (5.3)	
TL	6(3.1)	1(2.2)	5(3.3)	
IUCD	3(1.5)	1(2.2)	2(1.3)	
Total number	196(100.0)	46 (100.0)	150(100.0)	

Table 3: Prevalence of O~~o~~ther Vaginal I~~i~~nfections

Other infections	Count	Table Sum %
Yeast Cells	23	51.1%
Pus Cells	21	46.6%
Gonococci	1	2.2%
Total	45	100.0%

DISCUSSION

Bacterial vaginosis is a common cause of vaginitis that is encountered in many women of the reproductive age group, with an incidence. It has incidences variedying between 10-35% among patients visiting obstetrics and gynecology clinics and 20-60% in patients visiting the outpatient department [20] Centers for Disease Control (CDC) recommends that clinical bacterial vaginosis screening should be done through the Amsel's criteria. This involves checking the PH of the vaginal discharge which is usually more than 4.5 in the presence of BV, examining a wet preparation for clue cells and noticing an amine-like smell after adding 10% potassium hydroxide to the vaginal discharge. The other method is through gram staining the vaginal discharge, as the gold standard method and determining the population of lactobacilli, *Gadnerellavaginalis*, *bacteroides* and *mobilincus* species which are linked to BV [12,19]. The results were obtained based on the table below.

(table 4 and 5 should be written in material and methods section not here in the discussion section)

Table 4: Nugent Scores

Lactobacillus species	Gardnerella species	Curved rods	Score
>30	0	0	0
5-30	<1	1-5	1
1-4	1-4	>5	2
<1	5-30		3
0	>30		4

The attained scores were added to get the total scores going from 0-10 as illustrated below

Table 5: Score Interpretation

Score	Interpretation
0-3	Bacterial vaginosis negative
4-6	Intermediate
7-10	Bacterial vaginosis positive

Source [19]

We evaluated and scored Gram-stained smears,the ~~and~~ prevalence of Bacterial vaginosis was 23%. This is in agreement with a study done in Taiwan by Huang and colleagues in2023[21] which had a prevalence of 22.8% and 20.3% by Ndiaye and colleagues in 2023which was also very close to ours [22]. A study conducted in the year 2013 in Ethiopia had a prevalence of 19.4%which is near to current study result~~and not very different from ours~~[20]Another study conducted by Ambike and his colleagues had a prevalence of 23%, which exactly agrees with current study~~ours~~, even though it was done among pregnant women visiting ante-natal clinic [23]. Our prevalence however, differed considerably with that obtained by Lokken et al., in 2022 [24] whichwas 35%. However, their study had a sample size of 701 which was much larger compared to ours which was only 196, and this might have contributed to the difference.Our BV prevalence was also different from that registered by Majigo and colleagues in Tanzaniawhich had a prevalenceof 33.2% [25], even though they had a similar sample size as ours. This could have been due to interobserver variability from the microscopists. Our study revealed that BV was more prevalent among the married women at 56.5% and lowest among the widowed and divorced at 2.2% and 4.3% respectively, this can be explained by the fact that married women engage in sex frequently as opposed to divorced and widowed women and research has shown that sexual activity has a linkwith BV acquisition[26,27]. The high prevalence of BV among married women as opposed to widowed and divorced women was also registered by Mutuku and his colleagues in their study [7]. Please, write about strength, weakness and limitation of this study, together discuss well the risk factors of BV infection)

CONCLUSION

Bacterial vaginosis infection was more prevalent in women of 41-45 years old. There is a significant positive association between age and BV infection.

~~Bacterial vaginosis was more prevalent in the age group of 41-45 years old and age was significantly associated with BV.~~

CONSENT (WHERE APPLICABLE)

All procedures were clearly explained to the patients and those who agreed to take part in the study signed an informed consent form before their samples were obtained.

ETHICAL REVIEW (WHERE APPLICABLE)

This study was approved by the Kenyatta University Ethics Review Committee (PKU/2657/E1781), National Commission for Science and Innovation (NACOSTI/P/23/24582) and Kiambu Level-5 Hospital (KIAMBU/HRDU/23/04/04/RA)

REFERENCES **(please write the refetences in a uniform style according to the recommended style by the journal guidelines)**

1. Javed, Ayesha, Fahed Parvaiz, and Sobia Manzoor. "Bacterial vaginosis: An insight into the prevalence, alternative treatments regimen and its associated resistance patterns." *Microbial pathogenesis* 127 (2019): 21-30.
2. Russo, R., E. Karadja, and F. De Seta. "Evidence-based mixture containing Lactobacillus strains and lactoferrin to prevent recurrent bacterial vaginosis: a double blind, placebo controlled, randomised clinical trial." *Beneficial microbes* 10.1 (2019): 19-26.
3. Yusuf, M. A., Chowdhury, M., Islam, K. S., Eva, E. O., Sharif, A. R., Rahman, M. K., ... & Begum, S. A. (2013). Common microbial aetiology of abnormal vaginal discharge among sexually active women in Dhaka, Bangladesh. *South East Asia Journal of Public Health*, *1*(1), 35-39.
4. Demba, Edward, et al. "Bacterial vaginosis, vaginal flora patterns and vaginal hygiene practices in patients presenting with vaginal discharge syndrome in The Gambia, West Africa." *BMC infectious diseases* 5.1 (2005): 1-12.
5. Jespers, V., Crucitti, T., Menten, J., Verhelst, R., Mwaura, M., Mandaliya, K., ... & Vaginal Biomarkers Study Group. (2014). Prevalence and correlates of bacterial vaginosis in different sub-populations of women in sub-Saharan Africa: a cross-sectional study. *PloS one*, *9*(10), e109670
6. Woodman, Zenda. "Can one size fit all? Approach to bacterial vaginosis in sub-Saharan Africa." *Annals of clinical microbiology and antimicrobials* 15.1 (2016): 1-7.
7. Muia, MutukuOnesmus, et al. "Prevalence of Bacterial Vaginosis among HIV-Positive Women in Machakos County Hospital, Kenya." *Asian Research Journal of Gynaecology and Obstetrics* 5.1 (2021): 28-34.
8. Musyoki, Helgar, et al. "Prevalence of HIV, sexually transmitted infections, and risk behaviours among female sex workers in Nairobi, Kenya: results of a respondent driven sampling study." *AIDS and Behavior* 19 (2015): 46-58.
9. Nzomo, J., P. Waiyaki, and R. Waihenya. "Bacterial vaginosis and correlates in women of reproductive age in Thika, Kenya." (2013).
10. Sobel, J. D. (2000). Gynecologic infections in human immunodeficiency virus infected women. *Clinical Infectious Diseases, 31*(5), 1225-1233
11. Coughlin, Gabrielle, and Mimi Secor. "Bacterial vaginosis: update on evidence-based care." *Advance for Nurse Practitioners* 18.1 (2010): 41-4.
12. Workowski, Kimberly A., and Laura H. Bachmann. "Centers for Disease Control and Prevention's sexually transmitted diseases infection guidelines." *Clinical Infectious Diseases* 74.Supplement_2 (2022): S89-S94.
13. Verstraelen, Hans, et al. "The epidemiology of bacterial vaginosis in relation to sexual behaviour." *BMC infectious diseases* 10.1 (2010): 1-11.
14. Mengistie, Zemenu, et al. "Prevalence of bacterial vaginosis among pregnant women attending antenatal care in TikurAnbessa University Hospital, Addis Ababa, Ethiopia." *BMC research notes* 7 (2014): 1-5.
15. Bhujel, Rajshree, et al. "Comparative study of Amsel's criteria and Nugent scoring for diagnosis of bacterial vaginosis in a tertiary care hospital, Nepal." *BMC Infectious Diseases* 21.1 (2021): 1-6.
16. Muzny, Christina A., and Jane R. Schwebke. "Pathogenesis of bacterial vaginosis: discussion of current hypotheses." *The Journal of infectious diseases* 214.suppl_1 (2016): S1-S5.
17. Muzny, Christina A., et al. "Host–vaginal microbiota interactions in the pathogenesis of bacterial vaginosis." *Current opinion in infectious diseases* 33.1 (2020): 59-65.
18. Nayar, Ritu, and David C. Wilbur. "The Bethesda system for reporting cervical cytology: a historical perspective." *Actacytologica* 61.4-5 (2017): 359-372.
19. Nugent, Robert P., Marijane A. Krohn, and Sharon L. Hillier. "Reliability of diagnosing bacterial vaginosis is improved by a standardized method of gram stain interpretation." *Journal of clinical microbiology* 29.2 (1991): 297-301.

20. Mengistie, Zemenu, et al. "Comparison of clinical and gram stain diagnosis methods of bacterial vaginosis among pregnant women in Ethiopia." *Journal of clinical and diagnostic research: JCDR* 7.12 (2013): 2701.
21. Huang, Sung-Hsi, et al. "Prevalence, Associated Factors, and Appropriateness of Empirical Treatment of Trichomoniasis, Bacterial Vaginosis, and Vulvovaginal Candidiasis among Women with Vaginitis." *Microbiology Spectrum* (2023): e00161-23.
22. Ndiaye, Babacar, et al. "Bacterial Vaginosis: Prevalence and Risk Factors among Women in Dakar, Senegal." *Asian Journal of Research in Infectious Diseases* 12.1 (2023): 33-40.
23. Ambike, Abhijit S., et al. "Prevalence of asymptomatic and symptomatic bacterial vaginosis in pregnant women attending antenatal clinic in a tertiary care rural hospital." *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* 9.9 (2020): 3673.
24. Lokken, Erica M., et al. "Nugent Score, Amsel's Criteria, and a Point-of-Care Rapid Test for Diagnosis of Bacterial Vaginosis: Performance in a Cohort of Kenyan Women." *Sexually Transmitted Diseases* 49.1 (2022): e22-e25.
25. Majigo, Mtebe V., Paschal Kashindye, and Zachariah Mtulo. "Bacterial vaginosis, the leading cause of genital discharge among women presenting with vaginal infection in Dar es Salaam, Tanzania." *African Health Sciences* 21.2 (2021): 531-537.
26. Cherpes, Thomas L., et al. "A delicate balance: risk factors for acquisition of bacterial vaginosis include sexual activity, absence of hydrogen peroxide-producing lactobacilli, black race, and positive herpes simplex virus type 2 serology." *Sexually transmitted diseases* (2008): 78-83.
27. Fethers, Katherine A., et al. "Early sexual experiences and risk factors for bacterial vaginosis." *The Journal of infectious diseases* 200.11 (2009): 1662-1670.