# Bacterial vaginosis and associated risk factors in pregnant women attending Ante Natal Clinic at Pumwani Maternity Hospital –Kenya

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## ABSTRACT

**Introduction: Bacterial vaginosis [BV] is a syndrome characterized by a shift in vaginal flora. It is a strong independent risk factor for adverse pregnancy outcomes, found in 9% to 23% of pregnant women. Not many studies on BV have been conducted among the pregnant women attending Pumwani Maternity Hospital in Kenya. This study defined the prevalence and factors for prevalence of BV in pregnant women attending Pumwani Maternity Hospital in Nairobi, Kenya.**

**Methods: One hundred and fifty women who attended the Pumwani Maternity Hospital Ante natal clinic formed the basis of the study. This study received ethical approval from the Pumwani Maternity Hospital ante natal department and KEMRI ethics committee. Vaginal swabs were obtained from all the 150 women who consented and detailed demographic, sexual and genital hygiene interviews were collected. BV was tested using both the Amsel and Nugent's criteria.**

**Results: Of 150 participants, the mean age was 26.02 years, [range 22 [16 – 38] years], 72.7% were aged 21-30 years. Sixty eight percent were unemployed, 72.6% married, 20.7% reported previous STI including HIV, 74%, the age of sexual debut was less than 16 years; 78% had a regular sexual partner, 87.3% of them were circumcised male partners, 24% reported douching and 47.3% reported genital washing after sex. Twenty point seven percent had BV by Nugent's criteria. Bacterial vaginosis was associated with having given birth only once [20.3% vs. 19.1%; p=0.03], more than one previous birth [19.2% vs. 19.1%; p=0.026], previous STI [50% vs. 19.4%; p=0.042] and non-circumcised male partners [18.3% vs. 36.8%; p=0.033].**

**Conclusion: Bacterial vaginosis is prevalent among pregnant women. The factors associated with BV include partners not being circumcised, primiparous and a history of previous STI infections.**

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## INTRODUCTION

Bacterial vaginosis [BV] is the disturbed vaginal flora, in which normal lactobacilli are replaced by an overgrowth of various anaerobic bacteria which include *Gardnerella vaginalis* and *Mycoplasma hominis* among others [1]. It is particularly common in the sub-Saharan African region, where prevalence rates of upto 50% are common [2]. BV is the most common vaginal condition of reproductive age women and is the most frequently cited cause of vaginal discharge and malodor [1, 3,4].

Several studies have documented an increased risk for adverse pregnancy outcomes among women with conditions like bacterial vaginosis [5]. Data from epidemiological surveys show that within countries and between countries in the same region ,the prevalence and incidence of genital tract infections may vary widely even in similar population groups [6].Women with BV may be at increased risks of sexually transmitted disease, [STD] [7] and HIV. The vaginal, is susceptible to infection just like the cervix but the etiological agents are distinct because of ecological differences between the two sites. In women of reproductive age, the pH of the cervix is 7.0 while that of the healthy vagina is 3.5-4.5 [8]. The vagina is lined with squamous epithelial cells and the cervix lined with columnar epithelial cells. These differences select for specific pathogens, primarily *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in the cervix. A typical clinical symptom of BV is a thin, homogenous, gray, malodorous vaginal discharge, without significant pruritus or pain [9]. However, more than 50% of all women with BV are asymptomatic. Diagnosis of BV may be established by Amsel's clinical criteria whereby 3 of the 4 following signs are found: homogenous discharge, vaginal fluid pH > 4.5, positive amine test and microscopic analysis of Gram stained smear of vaginal discharge with clue cells seen [10]. An alternative diagnostic criterion utilizes Gram staining of vaginal secretions [11]. This is usually scored using Nugent criteria which is the standardized Gram stain method that is more accurate hence referred to us Gold standard [12]. The Nugent criteria involves standardized evaluation of morphtypes on Gram stain analysis for a decrease in Lactobacillus morphotypes and increase in Gardnerella, Mobiluncus and Bacteroides morphotypesand curved gram variable rods [13]. The treatment of BV consists of metronidazole or clindamycin orally or intravaginally [14].

A microbial foundation for BV has been demonstrated in which *Gardnerella vaginalis,* anaerobic bacteria and *Mycoplasma hominis* constitute the pathological core of BV [15]. Knowledge on the risk factors associated with acquisition and elimination of BV is needed for a better understanding of the disease and management of its outcomes.

## METHODS

### Study site and population

This study was carried out at Pumwani Maternity Hospital [PMH] antenatal clinic. PMH is the biggest maternity hospital in East Africa, having 80 to 100 deliveries in a day and is located in the Eastern part of Nairobi, Kenya. The hospital caters for expectant mothers; the majority being from the Eastland area of Nairobi and is of middle and low level socioeconomic backgrounds. The target population involved pregnant mothers aged between 18-49 years who were attending the antenatal clinic at PMH.

### Study design

This cross sectional study was carried out among pregnant women who attended the antenatal clinic at PMH between November and December 2010.

### Sample size estimation

The sample size of 150 was calculated based on the prevalence assumed to be 50% because some women are asymptomatic thus not easy to determine the exact prevalence. The total sample size was calculated using statistical Fischer's exact probability test, and therefore samples were used for the study calculated at 95% confidence interval.

The following formula was used to determine the sample size [Olive M, and Abel G, 1999]

$$n = Z^2 X pq / d^2$$

Z = Standard normal deviation at the required confidence interval

[1.96]

p = proportion in the target population estimated to have measured character

q = 1 – p

d = level of statistical significance at 95% confidence level = 0.05

Therefore, sample size calculation is;

$n = 1.96^{2\,x} [0.5 \times [1-0.5]]/0.05^2$

$= 1.96^2 \times 100$

=384 samples

Because the target population was less than 10,000, the final sample estimate was calculated as nf =n/1+n]/N [Culhane J, *et al* 2001]

Where nf=the desired sample size when population is less than 10,000

n=the desired sample size when population is more than 10,000

N=the estimate of the population size

Thus, nf=384/ 1+384]240

=147.6

150 samples

### Clinical diagnosis

This was done at the PMH Antenatal clinic where all pregnant women coming for routine checkups between the month of November and December in

the year 2010 were targeted. The investigator explained the intention of the study to the pregnant women individually after they were done with the checkups before leaving the clinic. Also the procedures and the benefits that they could get from the study if they agreed to participate. A total of 150 pregnant women aged between 18-49 years who gave written informed consent and signed were enrolled in the study. They underwent a face-to-face interview using a standardized questionnaire at the PMH clinic. Each patient's history was recorded. Demographic and clinical data recorded included age, weight, height, occupation, educational level, current marital status, smoking status, contraceptive use, parity and obstetric history. Data for HIV status was obtained from the records in the Antenatal clinic with the participants consent. Two vaginal swabs were taken from the vaginal wall blindly without the use of a speculum so as to target all flora available [16] by a Clinical Officer.

The Amsel clinical diagnosis was done at PMH clinic by the investigator involved and required that three of the following four criteria be met; first, a vaginal pH of greater than pH 4.5; second, the presence of clue cells in the vaginal fluid; third, a greyish homogenous vaginal discharge; and finally, the release of an amine [fishy] odor after addition of 10%pottassium hydroxide [KOH] to the vaginal fluid [8]. The pH was determined with use of the first swab which was touched on the pH paper in the range covering 4.0 to pH 6.5.The same swab was then extracted into 0.2ml of physiological saline in a test tube; a drop of the extract was mixed with a drop of 10% KOH which was taken on a glass slide. A fishy smell indicated a positive test. Two other drops from the physiological saline test tube were put on separate glass slides, covered with cover slips and examined at 400x magnification with a light microscope for the presence of clue cells and *Trichomonas vaginalis*. The vaginal epithelial cells which were completely covered by the gram variable coccobacilli so that their edges which normally have a sharply defined cell border became indistinct were considered as the clue cells [13]. This preparation was also used for detection of *Trichomonas vaginalis*.

**Laboratory procedures**

For Nugent scoring method, the second swab was smeared onto a slide air dried and then transported from PMH Antenatal Clinic at room temperatures to CMR Microbiology laboratory. The smear was then Gram stained by standard methods .The stained slide was read and the number of morphotypes evaluated based on a standardized scoring method [13]. It was then evaluated for the following morphotypes under oil immersion [1000x magnification]; large gram positive rods [lactobacilli], small gram negative/variable rods [*G.vaginalis* and anaerobic rods] and curved *Mobiluncus* species. A score of 0–3 was interpreted as consistent with normal vaginal

flora; a score of 4–6, corresponding to disturbed flora was designated as intermediate; and a score of 7–10 was considered positive for BV.

### Quality Control

Correct maintenance and set up of the microscopes was observed. Preparing and reading of Gram stains was observed by every read slide being confirmed by two other microscopists. Known positive Gram stain smears were always observed before observing newly prepared smears. Good practice made sure that the report on Gram stained smears mentioned the presence or absence of yeast cells.

### Statistical analyses

Both the quantitative and qualitative data were first reviewed to identify emerging themes, which were then coded for analysis. The qualitative data such prevalence of BV and demographic characteristics were calculated using chi-square.

## RESULTS

### Demographic characteristics of the study population

The mean age of 150 women enrolled into the study was 26.02 years {range 22 [16 – 38 years]; median 25.5 years; mode of 28 years} with a standard deviation of 4.5. Majority [72.7%] of the participants were aged 21 - 30 years with the least 4.7% being aged 18 to 20 years.

**Table1:** Education level by age group of the sampled population

| Education Level | Age Group 11 - 20 Years | | 21 - 30 Years | | 31 - 40 Years | | Total | | $\chi 2$ | df | P value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | | | |
| None | 0 | 0 | 2 | 1.8 | 0 | 0 | 2 | 1.3 | | | |
| Primary | 3 | 42.9 | 46 | 42.2 | 18 | 52.9 | 67 | 44.7 | 3.085 | 6 | 0.798 |
| Secondary | 4 | 57.1 | 48 | 44 | 12 | 35.3 | 64 | 42.7 | | | |
| Tertiary | 0 | 0 | 13 | 11.9 | 4 | 11.8 | 17 | 11.3 | | | |
| Total | 7 | 4.7 | 109 | 72.7 | 34 | 22.7 | 150 | | | | |

N - Number; % - Percent; $\chi 2$ Chi square; df - Degrees of freedom; P value - Level of significance

There were two near equal peaks 42.2% and 44% of those with primary and secondary education being aged 21 to 30 years. The distribution of education level by age groups was not significantly different ($\chi 2 = 3.085$; df = 6; P value= 0.79) as shown in table 1 above.

**Table 2:** Sexual health characteristics of sampled population

| Characteristics | Frequency | Percent | $\chi 2$ | df | P value |
|---|---|---|---|---|---|
| **HIV status** | | | | | |
| Positive | 25 | 16.7 | 66.67 | 1 | 0.001 |
| Negative | 125 | 83.3 | | | |
| **Previous STI infection** | | | | | |
| Yes | 6 | 4 | 124.97 | 1 | 0.0001 |
| No | 144 | 96 | | | |
| **Vaginal irritation** | | | | | |
| Yes | 68 | 45.3 | 1.13 | 1 | 0.29 |
| No | 82 | 54.7 | | | |
| **Vaginal discharge** | | | | | |
| Yes | 38 | 25.3 | 32.83 | 1 | 0.001 |
| No | 112 | 74.7 | | | |
| **Lower abdominal pain** | | | | | |
| Yes | 57 | 38 | | | |
| No | 92 | 61.3 | 84.28 | 2 | 0.0001 |
| Decline | 1 | 7 | | | |

$\chi 2$ - Chi square; df - Degree of freedom; P - Level of significance; HIV – Human immunodeficiency Virus; STI – Sexual Transmitted Diseases

Table 2 shows that approximately 16.7% of the women were HIV positive as per the Antenatal clinic card, with 38% of the women experiencing lower abdominal pain. Near half of women 45.3% reported experiencing vaginal irritation during the period of the study. Approximately one fourth (25.3%) of the women reported experiencing vaginal discharge during the period of study. Four percent of them were reporting previous STI infection ($x^2$=124.97; df=1; P value=0.0001)

**Table 3:** Sexual behavior genital hygiene of sampled population

| Characteristics | Frequency | Percent | χ2 | df | P value |
|---|---|---|---|---|---|
| **Age of debut** | | | | | |
| 11-15 | 45 | 30 | | | |
| 16-20 | 66 | 44 | | | |
| 21-25 | 20 | 13.3 | 71.06 | 3 | 0.0001 |
| 26-30 | 2 | 1.3 | | | |
| Declined | 17 | 11.3 | | | |
| **Number of sexual partners** | | | | | |
| None | 9 | 6 | | | |
| 1 | 117 | 78 | 443.87 | 2 | 0.001 |
| > 1 | 24 | 16 | | | |
| **Partner circumcised** | | | | | |
| Yes | 131 | 87.3 | | | |
| No | 10 | 6.7 | 215.79 | 2 | 0.001 |
| Decline | 9 | 9.0 | | | |
| **Contraceptive use** | | | | | |
| None | 68 | 44.7 | | | |
| Pills | 68 | 45.3 | | | |
| IUCD | 3 | 2 | 218.96 | 4 | 0.001 |
| Norplant | 1 | .7 | | | |
| Others | 10 | 6.7 | | | |
| **Practice douching** | | | | | |
| Yes | 36 | 24 | 36.75 | 1 | 0.001 |
| No | 114 | 76 | | | |
| **Previous abortion** | | | | | |
| Yes | 44 | 29.3 | | | |
| No | 104 | 69.3 | 107.72 | 2 | 0.001 |
| Decline | 2 | 1.4 | | | |
| **Genital washing after sex** | | | | | |
| Yes | 71 | 47.3 | | | |
| No | 78 | 52.0 | 71.85 | 2 | 0.001 |
| Decline | 1 | .7 | | | |

χ2 - Chi square; df - Degree of freedom; P Value- Level of significance; IUCD – Intrauterine Contraceptive Device

Most of the participants (78%) were currently having one sexual partner while about 16% had more than one sexual partner. The most (45.3%) commonly used contraceptive was the pill with the same percentage (45.3%) of the women not using any contraceptive. Approximately 24% of the women practiced douching with 29.3% of them reporting having procured an abortion previously. Nearly half (47.3%) of the women reported washing on the outside of their genitals immediately after sexual encounters. Majority (87.3%) had their sexual partners circumcised ($x^2$=215.79; df=2; P value=0.001) as shown in table 3 above.

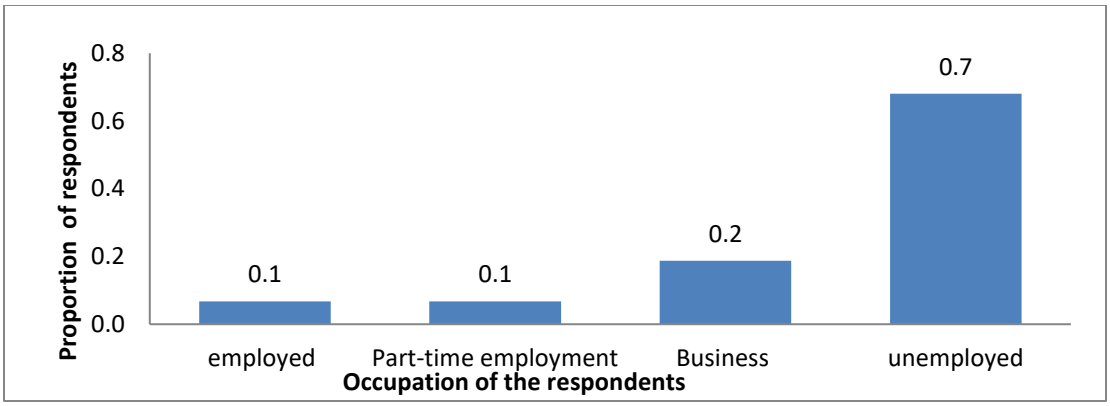


**Figure 1:** Occupation characteristics of the respondents

Figure 1 shows that majority (68%) of the participants were unemployed while the rest were either business women (18.7%) or 13.4% employed (6.7% employed and 6.7% in self-employment) ($\chi 2$ = 153.68; d6f = 3; P = 0.001).

**Parity of the sampled population**

Fifty six percent of the participants had given birth at least once [39.3% one previous births and 17.3% more than one previous births] while 43.3% of the women were currently expectant. The mean number of previous births was 0.79 {range 4 [0 – 4], median 1 and a standard deviation of 0.87.

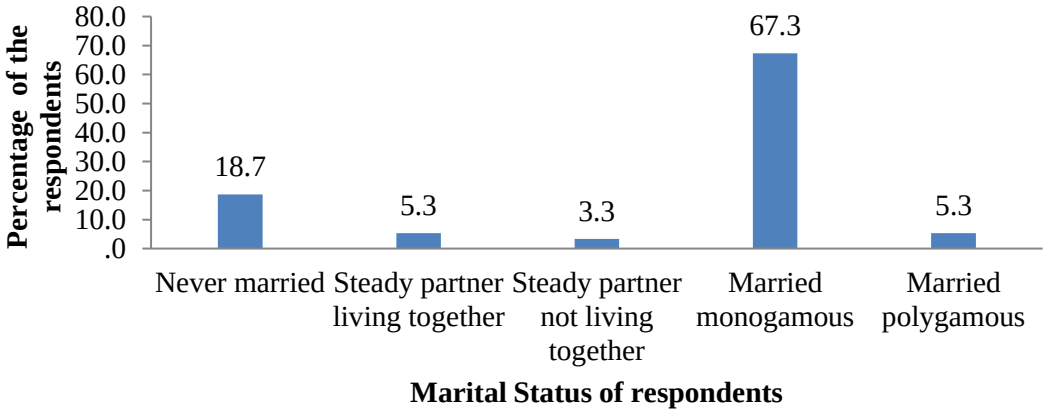


**Figure 2:** Marital status of respondents

Figure 2 shows that more than three quarters of women in this study were in a steady relationship and only 18.7% were single and had never married. The majority (67.3%) of the women were in a monogamous marriage with approximately 5.3% being in a polygamous marriage ($\chi 2$ = 221.26; df = 4; P = 0.0001).

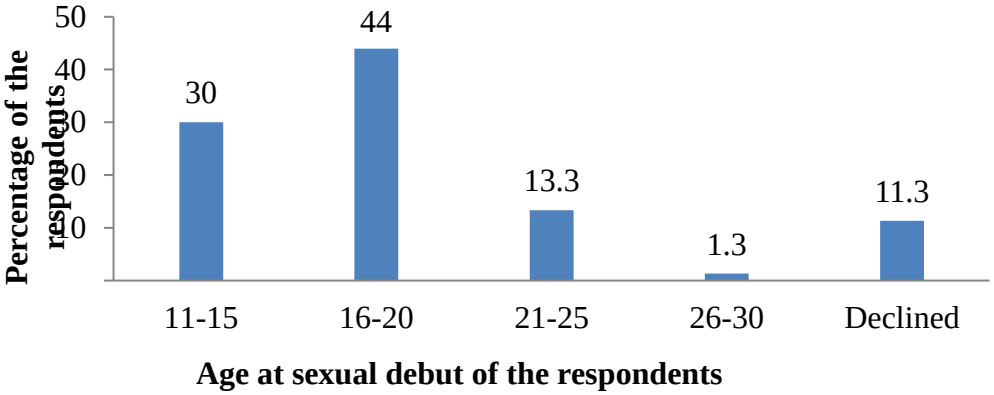


**Figure 3**: Age at sexual debut of the respondents

Figure 3 shows that the mean age of sexual debut for the women in this study was 17.5 years {range 17 (19 – 29 years), median 17 years, with a standard deviation of 3.3. Majority (74%) of the participants had first sex at the age less than 16 years (30% between the age of 11 to 15 years and 44% at the age of 16 - 20 years) ($\chi 2 = 71.06$; df = 4; P = 0.001).

**Prevalence of bacterial vaginosis among pregnant women attending antenatal clinic at Pumwani Maternity Hospital**

The prevalence of BV varied depending on the test used although there was no significant different: 31/150 [20.7%; 95% CI 14.9– 27.9] by Nugent criteria and 35/150 [23.3%; 95% CI 17.3 – 30.7] by Amsel criteria as shown in Figure 4.

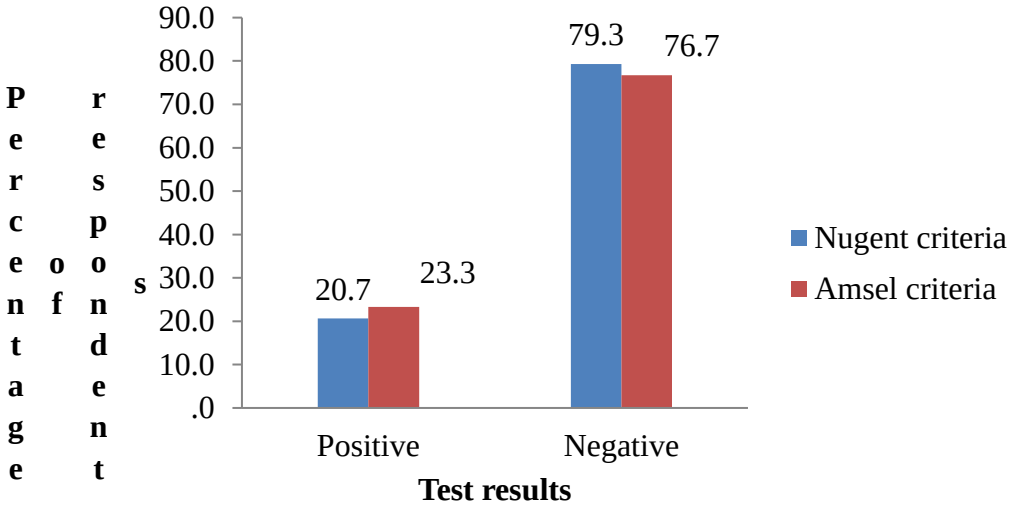


**Figure 4:** Bacterial Vaginosis Test results for Nugent and Amsel criteria

**Table 4:** Demographic characteristic-specific prevalence of Bacterial Vaginosis infection and bivariate prevalence ratios for classical Bacterial Vaginosis infection [versus non-classical Bacterial Vaginosis infection]

| Characteristics | Sample size | BV infection | | P value | Bivariate | P value | Multivariate |
|---|---|---|---|---|---|---|---|
| | | N | % | | PR (95% CI) | | PR (95% CI) |
| **Education** | | | | | | | |
| None | 2 | 0 | 0 | 1 | ND | 0.996 | |
| Primary | 67 | 16 | 23.9 | 0.979 | 1.1(0.33 - 3.03) | 0.892 | NS |
| Secondary | 64 | 11 | 17.2 | 0.591 | 0.73(0.23 - 2.29) | 0.702 | |
| Tertiary | 17 | 4 | 23.5 | Referent | Referent | Referent | |
| **Age group** | | | | | | | |
| 11 to 20 | 7 | 0 | 0 | 1 | ND | ND | NS |
| 21 to 30 | 109 | 26 | 23.8 | Referent | Referent | Referent | |
| 31 to 40 | 34 | 5 | 14.7 | 0.322 | 1.6 (0.62 - 4.22) | 0.994 | |
| **Marital Status** | | | | | | | |
| Single | 28 | 8 | 28.6 | Referent | Referent | Referent | |
| Married Monogamous | 101 | 18 | 17.8 | 0.904 | 0.93(0.27 - 3.08) | 0.994 | NS |
| Married Polygamous | 8 | 1 | 12.5 | 0.323 | 0.57(0.19 - 1.71) | 0.327 | |
| Steady Relationships | 13 | 4 | 30.8 | 0.42 | 0.41(0.05 - 3.63) | 0.677 | |
| **Occupation** | | | | | | | |
| Business | 28 | 4 | 14.3 | 0.75 | 1.43 (0.15 - 12.78) | 0.278 | |
| Employed | 10 | 2 | 20 | 0.571 | 2 (0.18 - 22.05) | 0.816 | NS |
| Part-time employec | 10 | 1 | 10 | 0.402 | 2.35(0.32 - 17.39) | 0.444 | |
| Unemployed | 102 | 24 | 23.5 | Referent | Referent | Referent | |
| **Parity** | | | | | | | |
| None | 63 | 12 | 19.1 | Referent | Referent | Referent | |
| One | 59 | 12 | 20.3 | 0.037 | 0.21(0.04 - 0.91) | 0.026 | 0.10(0.01 - 0.75) |
| More than one | 26 | 5 | 19.2 | 0.049 | 0.19(0.03 - 0.99) | 0.03 | 0.09(0.01 - 0.79) |

NS - Not significant; ND - Not done; PR - Prevalence ratio; CI - Confidence interval; N - Number; % - Percentage; BV- Bacterial Vaginosis Referent-referred to

In multivariate analyses, women who had one previous birth were 10% less likely to be infected with BV compared to those who were currently pregnant and no previous births (PR 0.10, 95% CI 0.01 to 0.75). Further, women who had given birth to more than one child were 9% less likely to have BV compared to those who were currently pregnant and no previous births (PR 0.09, 95% CI 0.01 to 0.79) as indicated in table 4.

**Table 5:** Sexual practices characteristic-specific prevalence of Bacterial Vaginosis infection and bivariate prevalence ratios for classical Bacterial Vaginosis infection [versus non-classical Bacterial Vaginosis infection]

| Characteristics | Sample size | BV infection | | P value | Bivariate | P value | Multivariate |
|---|---|---|---|---|---|---|---|
| | | No | % | | PR (95% CI) | | PR (95% CI) |
| **T. vaginalis infection** | | | | | | | |
| Yes | 7 | 3 | 42.9 | 0.197 | 2.19(0.67 - 7.19) | 0.499 | NS |
| No | 143 | 28 | 19.6 | Referent | Referent | Referent | |
| **Yeast infection** | | | | | | | |
| Yes | 39 | 7 | 17.9 | 0.665 | 0.83(0.36 - 1.93) | 0.232 | NS |
| No | 111 | 24 | 21.6 | Referent | Referent | Referent | |
| **HIV status** | | | | | | | |
| Positive | 25 | 3 | 12 | 0.304 | 0.54(0.16 - 1.76) | 0.188 | NS |
| Negative | 125 | 28 | 22.4 | Referent | Referent | Referent | |
| **Vaginal Ph** | | | | | | | |
| ≤ 4.5 | 84 | 10 | 11.9 | Referent | Referent | Referent | NS |
| ≥4.5 | 66 | 21 | 31.8 | 0.011 | 2.67(1.26 - 5.67) | 0.142 | |
| **Amines (Fishy smell)** | | | | | | | |
| Yes | 51 | 19 | 36.5 | 0.003 | 2.98(1.44 - 6.14) | 0.119 | NS |
| No | 98 | 12 | 12.2 | Referent | Referent | Referent | |
| **Previous STI infection** | | | | | | | |
| Yes | 6 | 3 | 50 | 0.12 | 2.57(0.78 - 8.45) | 0.042 | 3.58(1.04 - 12.23) |
| No | 144 | 28 | 19.4 | Referent | Referent | Referent | |
| **Vaginal irritation** | | | | | | | |
| Yes | 68 | 18 | 26.5 | 0.159 | 0.59(0.29 - 1.22) | 0.482 | NS |
| No | 82 | 13 | 15.6 | Referent | Referent | Referent | |
| **Vaginal discharge** | | | | | | | |
| Yes | 38 | 14 | 36.8 | 0.014 | 2.43(1.19 - 4.92) | 0.514 | NS |
| No | 112 | 17 | 15.2 | Referent | Referent | Referent | |
| **Lower abdominal pain** | | | | | | | |
| Yes | 57 | 12 | 21.1 | 0.935 | 1.03(0.5 - 2.12) | 0.876 | NS |
| No | 93 | 19 | 20.4 | Referent | Referent | Referent | |

NS - Not significant; ND - Not done; PR - Prevalence ratio; CI - Confidence interval; No - Number; % - Percentage

Table 5 shows that in bivariate analysis, women who had *T. vaginalis* and yeast infections were more likely to be infected with BV compared with those who had neither *T. vaginalis* nor yeast infections. Also, women who were HIV positive were more likely to have BV compared with those who were HIV negative (PR 0.57, Cl 0.16 to1.76). In multivariate analyses, women who had previous STI infection were 58% times more likely to be infected with BV compared to women who were not previously infected with an STI (PR 3.58, 95% CI 1.04 to 12.23).

**Table 6:** Genital hygiene characteristic-specific prevalence of Bacterial vaginosis infection and bivariate prevalence ratios for classical Bacterial vaginosis infection (versus none classical Bacterial vaginosis infection)

| Characteristics | Sample size | BV infection | | P value | Bivariate | P value | Multivariate |
|---|---|---|---|---|---|---|---|
| | | N | % | | PR (95% CI) | | PR (95% CI) |
| **Age of debut** | | | | | | | |
| 11-15 | 45 | 10 | 22.2 | 0.726 | 1.25(0.34 - 4.58) | 0.99 | |
| 16-20 | 66 | 12 | 18.2 | 0.963 | 1.03(0.29 - 3.65) | 0.99 | NS |
| 21-25 | 20 | 6 | 30 | 0.453 | 1.69(0.42 - 6.79) | 0.99 | |
| 26-30 | 2 | 0 | 0 | 0.999 | ND | 0.99 | |
| Declined | 17 | 3 | 17.7 | Referent | Referent | Referent | |
| **Number of previous sexual partners** | | | | | | | |
| None | 9 | 2 | 22.2 | 0.885 | 0.78(0.32 - 1.93) | 0.47 | NS |
| 1 | 117 | 23 | 19.7 | 0.6 | 1.13(0.22 - 5.57) | 0.825 | |
| > 1 | 24 | 6 | 25 | Referent | Referent | Referent | |
| **Partner circumcised** | | | | | | | |
| Yes | 131 | 24 | 18.3 | 0.104 | 0.49(0.21 - 1.15) | 0.033 | 0.37(0.15 - 0.92) |
| No | 10 | 7 | 36.8 | Referent | Referent | Referent | |
| **Contraceptive use** | | | | | | | |
| None | 68 | 15 | 22.1 | Referent | | Referent | |
| Pills | 68 | 13 | 19.1 | 1 | | 0.993 | |
| IUCD | 3 | 1 | 33.3 | 1 | ND | 0.993 | NS |
| Norplant | 1 | 0 | 0 | ND | | 0.993 | |
| Others | 10 | 2 | 20 | 1 | | 0.993 | |
| **Practice douching** | | | | | | | |
| Yes | 36 | 8 | 22.2 | 0.814 | 1.11(0.49 - 2.46) | 0.879 | NS |
| No | 114 | 23 | 20.2 | Referent | Referent | Referent | |
| **Previous abortion** | | | | | | | |
| Yes | 44 | 10 | 22.7 | 0.666 | 0.84(0.39 - 1.81) | 0.418 | |
| No | 104 | 20 | 19.2 | Referent | Referent | Referent | NS |
| Decline | 2 | 1 | 50 | 0.452 | 2.2(0.28 - 17.180 | 0.45 | |
| **Genital washing after sex** | | | | | | | |
| Yes | 69 | 16 | 23.2 | 0.532 | 1.25(0.62 - 2.53) | 0.827 | NS |
| No | 81 | 15 | 18.5 | Referent | Referent | Referent | |
| **Number of undergarments** | | | | | | | |
| ≤ 7 | 21 | 3 | 20.7 | Referent | Referent | Referent | NS |
| ≥ 7 | 129 | 28 | 21.7 | 0.491 | 1.52(0.46 - 4.99) | 0.494 | |

NS - Not significant; ND - Not done; PR - Prevalence ratio; CI - Confidence interval; N - Number; % - Percentage Referent- Referred to.

In both bivariate and multivariate analyses BV was not associated with the age at sexual debut although those women who had sex for the first time at the age of 16-20 years were more likely to be infected with BV. There were no significant relationships between BV and douching and also between BV and number of sexual partners. In multivariate analysis women whose sexual partners were circumcised were less likely to be infected with BV compared to those whose partners were not circumcised (PR 0.37, 95% CI 0.15 to 0.92) as shown in table 6.

## DISCUSSION

### Prevalence

Different studies have identified varying BV prevalence in different settings including; 6.4% among pregnant women in Burkina Faso [17], 8.6% among pregnant women in India [18] and 16% among pregnant women in Denmark [19]. In a study conducted in Jamaica on the prevalence and risk factors of vaginal infections in pregnant women 44.1% had BV [20]. Also there was a prevalence of 19.9% among the patients in Belgium [21], 38.8% among STD clinic attendees in USA [22], 43% among the family planning and STD clinic attendees in USA [23] and 44% among female participants attending STD clinic in Kenya [24].

### Factors associated with Bacterial Vaginosis

Lack of male circumcision has been associated with a number of STIs, including genital ulcer disease [25, 26] and acquisition of HIV in men [26]. It is therefore biologically plausible that, if BV is transmitted by males, the foreskin could facilitate survival of BV organisms and render an uncircumcised male a more efficient or more prolonged transmitter of the infection

Women who had previous STI infection other than *T. vaginalis* and HIV were likely to be infected with BV compared to women who were not previously infected with an STI [PR 3.58, 95% CI= 1.04 to 12.23]. However, there were no significant associations identified between BV and T. *vaginalis* and also BV and HIV status. Paavonen *et al.*, 1983 [27], found that women with a previous sexually transmitted disease are at increased risk of BV. Bacterial vaginosis is more prevalent among women with a prior or current sexually transmitted disease. However, the occurrence of BV may be the direct consequence of exposure to the infectious pathogen, not the sexual behavior. Although sexually transmitted diseases and BV commonly coexist, particularly trichomoniasis and BV, BV is not considered a sexually transmitted disease [28]. Also the association between BV and the risk of HIV infections has been demonstrated in several longitudinal studies [29], where HIV was more frequent in BV positive women than those without BV. Moreover, Sub Saharan African women, whose vagina microbiota was not dominated by lactobacilli, were found to be 2-3times more likely to be infected with HIV, even when other HIV risk factors were taken into account. It has been suggested that a decrease in $H_2O_2$-producing lactobacilli in BV might contribute to increased rates of HIV infections in women with BV. It is widely believed that the acidic environment of the vagina in women afforded by lactobacilli contributes to the protection against HIV infection [29]. There is a growing literature on the relationship between BV and an increased risk of acquiring HIV-1 infection. *Gardnerell*a v*aginali*s has been shown to activate HIV expression in

monocytic and some T cells. The level of expression varied with the strain of *Gardnerella vaginalis* tested [30]. In a study by Prosper *et al.*, 2012, the results showed no association between BV and HIV infection [OR 0.90 [95%CL, 0.28-2.92; p=0.863] and this concurred with the findings in this study.

The findings of these study of being less likely to be infected with BV with a past pregnancy contradict a previous study by Smart *et al*., 2004 [31], who found that women with BV were more likely to have a past pregnancy than controls [P<0.001]. However, Prosper *et al.*, 2012 [32], found no evidence of association between bacterial vaginosis and having ever delivered before [OR 0.66 [95% CL= 0.39-1.12; p=0.126]].

There was no significant association between BV and contraceptive use although the mostly used was the pill [n=68] with the same number not having used any contraceptive .This association has been evident in a number of published studies. Hormonal contraceptive, mainly combined methods have been reported to be protective against prevalent incident [21].While there are a number of confounding factors that may explain this association, it is consistently evident in the literature, and in many analyses. There are also biological plausible explanations for this apparent association. A number of cross-sectional and longitudinal studies have shown a reduced risk of BV in women using hormonal contraceptives [21,14]. It has been hypothesized that oestrogen increases the glycogen content of epithelial cells, a substrate for lactobacillus species to generate lactic acid, which appears to be a potent inhibitor of BV-associated bacteria. It is possible that contraceptive use influences the vaginal immune response, with Cherpes and co-workers reporting an association between hormonal contraceptive use and altered vaginal immunity in BV [33]. Smart *et al.*,2004 [31], also concluded that women with BV were significantly less likely to have used hormonal contraception [OR=0.6, 95%CL; 0.51-0.81].

Incidents of BV were not associated with having more than one sexual partner. A number of investigators have reported an association between the development of BV and exposure to a new male partner. Smart *et al*., 2004[31], reported that women with two or more male partners in the past 3months [OR=1.50, 95%CL; 1.18 to 1.85] and three or more in the past 12months [OR=1.60, 95%CL; 1.27 to 2.02] were significantly more likely to have BV than those with fewer partners [14], reported that BV recurrence was 3 times more common among women who changed sexual partners and was significantly less likely among women who remained with their regular sexual partner after treatment.

Despite the fact that several cross-sectional studies have shown that frequent douching is associated with bacterial vaginosis [34], it remains uncertain whether women douche in response to symptoms of bacterial vaginosis. Onderdonk *et al.,* 1992 [35], demonstrated that use of 0.04% vinegar douche caused a transient reduction of total bacterial counts, with most of the reduction attributable to the effect of washing the vaginal surface as noted with physiologic saline. The vaginal flora quickly recovered the levels measured before douching. The authors concluded that repetitive use of vinegar solution most likely might not alter vaginal microflora in a biologically important way. In a study by Ness *et al.,*2002[34], women who douched less than once per month had no increased risk of bacterial vaginosis [adjusted OR=1.0, 95%CL= 0.6-1.7]. Some of the risk factors found associated with BV infection which were not studied or found associated with BV included lower socio economic status, yeast cells, previous abortion, education level, age at debut, occupation, and marital status,

## CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

### Conclusions

The prevalence of this study is much high compared to other studies such as 8.6% among pregnant women in India and 16% among pregnant women in Denmark.

Bacterial vaginosis is associated with factors such as male sexual partner not being circumcised, primiparous and previous STI's infection other than HIV and *T. vaginali.*

### Recommendations

Routine screening for BV should be carried out among pregnant women in order to prevent its adverse outcome. Bacterial vaginosis could be incorporated into existing STI's prevention programmes.

Multidisciplinary expertise which guarantees motivation and enhances information quality about STI's and male circumcision and also treatment of STI's is required. Relationship between BV and primiparous needs further exploration.

### Limitations

Limitations included the small number of study participants and cross-sectional rather than prospective study design

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