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## Abstract

**Background:** Bacterial vaginosis (BV) is a polymicrobial, superficial vaginal infection involving a reduction in the amount of hydrogen peroxide-producing *Lactobacillus* and overgrowth of anaerobic bacteria. Common symptoms include increased fishy smelling vaginal discharge which is usually white or gray in color. Burning with urination may occur and itching is uncommon. Risk factors include douching, new or multiple sex partners, antibiotics, and use of intrauterine device among others.

**Materials and Methods:** This cross-sectional study assessed the prevalence of bacterial vaginosis among sexually active women aged 15-45 years. Vaginal swabs were obtained with the use of sterile swab sticks which were later smeared on clean glass slides and then Gram stained. The stained smears were observed for bacterial morphotypes with the X100 oil immersion objective and the Nugent scoring system was used to determine BV. Data were analyzed using the Statistical Package for Social Scientists (SPSS) version 17.0 and were considered significant at  $p \leq 0.05$ .

**Results:** A total of 100 women participated in the study with the overall prevalence of BV rated 38%. The prevalence of BV with respect to associated factors was also investigated and it was observed that BV was more prevalent in the age groups 20-25 (48.1%) and 25-29 (44.4%), those who had attained only primary education (60.5%), married women, (68.4%), pregnant women (71.0%), and women who practiced vaginal douching, (97.4%). However, no statistical significant difference was observed in the prevalence between these parameters ( $P > 0.05$ ).

**Conclusions:** Conclusively, the prevalence of bacterial vaginosis in our study population is 38% and highest among women aged between 25 and 34 years, pregnant women, married women, less educated women and women who practiced poor vaginal hygiene.

**Key words:** Bacterial vaginosis, sexually active women aged 15-45 years.

## Introduction

Reproductive-tract infections (RTI) including bacterial vaginosis, are major public health concerns among sexually-active women in developing countries with bacterial vaginosis alone being responsible for 40-50% of vaginal infections (Spiegel, 1991). Bacterial vaginosis (BV) is a polymicrobial, superficial vaginal infection involving a reduction in the amount of hydrogen peroxide-producing *Lactobacillus* and overgrowth of anaerobic bacteria. The reduced numbers of *Lactobacillus* allow overgrowth of anaerobic bacteria, especially *Mycoplasma hominis*, *Bacteroides* species, *Mobiluncus species* and *Gardnerella vaginalis*. Although most of these organisms are present in small number in the normal vagina, *Mobiluncus species* are rarely found and indicates a sensitive marker for the diagnosis of BV. However, recent studies suggests that *G. vaginalis* is the key player in the pathogenesis of BV initiating the development of a biofilm and then becomes the scaffolding to which other species adhere (Verstraelen *et al.*, 2013). Past studies on the microbiota of the epithelial surfaces of vaginal biopsy from women with BV showed that *G. vaginalis* comprised 90% of the bacteria in the biofilm (Swidsinski *et al.*, 2005).

Bacterial vaginosis is an extremely prevalent condition and the number one cause of vaginitis among sexually active women (Yudin and Money, 2008). Although it is not a reportable disease, available data show the prevalence of BV among non-pregnant women to range from 15% to 30% and 50% for pregnant women (Fleury *et al.*, 1981; Shayo *et al.*, 2012). However, the majority of cases of BV are asymptomatic and remain unreported and untreated (Amsel *et al.*, 1983). Fifty to 75 percent of women with bacterial vaginosis (BV) are asymptomatic. Symptomatic women typically present with vaginal discharge and/or vaginal odor. The discharge is off-white, thin, and homogeneous; the odor is an unpleasant "fishy smell" that may be more noticeable after sexual intercourse and during menses.

Previously considered a benign condition, BV has been implicated in many gynecologic conditions and complications of pregnancy including pelvic inflammatory disease, post hysterectomy vaginal cuff cellulites, endometriosis, amniotic fluid infection, preterm delivery, preterm labor, premature rupture of the membranes, and possibly spontaneous abortions (Eschenback *et al.*, 1988). A cross sectional study carried out in Bangladesh reported that reproductive tract infections (RTI), including bacterial vaginosis, are a major public-health problem among sexually active women. Among RTI investigated, bacterial vaginosis was responsible for 40 - 50% of vaginal infections in sexually -active women (Spiegel, 1991).

Bacterial vaginosis (BV) resolves spontaneously in up to one-third of non-pregnant and one-half of pregnant women (Klebanoff *et al.*, 2004). Treatment is indicated for relief of symptoms in women with symptomatic infection and to prevent postoperative infection in those with symptomatic and asymptomatic infection prior to abortion or hysterectomy or any post vaginal surgical procedure. Treatment of BV may also reduce the risk of acquiring sexually transmitted diseases (STDs), including human immunodeficiency virus (HIV) (Schwebke *et al.*, 2004). For this reason, some experts support the concept of treating all women with BV regardless of presence or absence of symptoms.

Risk factors for BV include sexual activity, new or multiple sexual partners and early age of sexual intercourse. Epidemiologic studies are strongly supportive of sexual transmission of BV pathogens and most experts believe that BV does not occur in women who have never had vaginal intercourse (Yen *et al.*, 2003). However, BV can develop in women who have never had sexual intercourse, probably because of other factors that may destabilize the normal vaginal flora such as douching and wearing of tight fitting underwear (Papanikolaou *et al.*, 2002; Fethers *et al.*, 2009). Distortion of the vaginal flora may also result from sexual activity alone without necessary transmission of the BV pathogens to susceptible sexual partners (Holzman *et al.*, 2001). Generally, the use of an intrauterine contraceptive device, douching, wearing of tight fitting underwear and personal hygiene are reported as risk factors for BV (Chiaffarino *et al.*, 2004; Klebanoff, 2010). Infection seems to be most common around the time of menstruation. There is a high occurrence of BV and concordance of flora in women who have sex with women, further suggesting sexual transmission is important. It is not clear, however, whether one type of sexual activity may be more important in the pathogenesis of infection than another. As an example, oral-genital sex may be a more important risk factor than penile intromission into the vagina. Although some degree of genetic susceptibility to BV is likely, no association between a gene polymorphism and BV has been established.

Bacterial vaginosis is a risk factor for acquisition of herpes simplex virus type 2 (HSV-2), gonorrhoea, and chlamydial infection (Cherpes *et al.*, 2003). The incidence of BV has also been associated with a greater occurrence of other sexually transmitted infections like HIV and cytomegalovirus (Joesoef *et al.*, 1995).

## **Materials and Methods**

### **Ethics Statement**

The study was approved by the Institutional Review Board of Saint Monica University Buea, Cameroon while administrative authorization to collect clinical samples was obtained from the CDC Central Clinic, Tiko, where the study was conducted. Written informed assent was obtained from the patients and data was treated with discrete confidentiality.

### **Study Population**

The study population was drawn from the population of women attending the CDC Central Clinic, Tiko, South West of Cameroon from January to June 2014. A total of 100 sexually active women aged from 15 to 45 years, who met the inclusion criteria were recruited in this study. After detailed explanation of the study objectives and protocols by the researcher, the women gave their consent to participate in the study by signing informed consent forms. Sexually active women who refused to give their consent or who were menstruating at the time of recruitment were excluded from the study.

### **Socio-demographic Data**

A structured questionnaire was used to collect participants' socio-demographic data. Taken into consideration were the participant's age, marital status, pregnancy, knowledge of BV, clinical data, and other variables.

### **Samples**

The samples analyzed were vaginal swabs and were collected aseptically from the women with the use of sterile swab sticks. The participant was instructed to lie on the collection bed in a supine position. With both legs flexed, the labial majora was held apart by the participant. A labeled sterile swab was carefully inserted into the vagina and discharge was collected by gently rolling the inserted swab. The swab sticks were recapped and refrigerated (at 4°C) for further processing at the end of each day.

### **Diagnosis of Bacterial Vaginosis**

The Nugent criteria for the diagnosis of BV were employed (Nugent *et al.*, 1991). According to this method, three bacterial morphotypes – *Lactobacillus*, *Mobiluncus* and *Gardnerella* were used as markers of BV. Vaginal swabs were used to prepare smears on clean, grease-free slides. The smears were allowed to air-dry and then fixed with 95% alcohol. The smears were then Gram stained using the Jenson's modified Gram technique as described by Cheesbrough (2006). The Gram stained smears were observed under the light microscope (Olympus) using the oil immersion objective (x100). *Lactobacillus* morphotypes were reported as large Gram positive bacilli, *Mobiluncus* as curved Gram negative or Gram variable rods while *Gardnerella* were reported as small Gram variable bacilli. Using the Nugent scoring technique, scores ranged from 0 to 4 for *Lactobacillus*; 0 indicating that  $\geq 30$  organisms were found and 4 indicated that no organisms were found. In contrast, for *Gardnerella*, a score of 0 indicated that no organisms were found and 4 indicated  $\geq 30$  organisms. For *Mobiluncus*, scores ranged from 0 to 2; 0 indicating no organisms and 2 indicating  $\geq 5$  organisms. A total numerical score was calculated (ranging from 0 to 10) for each sample by summing the scores for each of the

three morphotypes. The scores were classified into one of three ranges to define a case of BV; a score in the range 0-3 indicated normal vaginal flora, 4-6 indicated altered vaginal flora which is not consistent with BV, and 7-10 was consistent with BV.

**Data Analysis**

Data obtained from this study was entered into the computer Microsoft Excel and analyzed using SPSS version 17.0. The Chi square test was used to determine the differences in the distribution of bacterial vaginosis. Statistical significance was considered at  $p \leq 0.05$ .

**Results**

**Socio-demographic Data**

Participants’ socio-demographic data are presented in Table 1. Of the 100 participants, 54 (54%) were equally distributed between the age ranges 25-29 and 30-34 years while only a few fell in the age ranges of 15-19 years (5%) and 40 years or more (6%). More married women participated in the study (62%) as well as pregnant women (59%). With regards to educational level, 55% of the participants had attained only primary qualification and only one had never been to school.

**Table 1: Participants’ sociodemographic data**

Parameter	Responses	Number/100
Age (years)	15-19	5
	20-24	14
	25-29	27
	30-34	27
	35-39	21
	≥40	6
Marital Status	Married	62
	Single	38
Education	Never been to school	1
	Primary	55
	Secondary	24
	High school	14
	Post high school	6
Pregnancy status	Pregnant	59
	Not pregnant	41

**Participants’ Knowledge of Bacterial Vaginosis and Practices that Pre-dispose them to the Infection**

Information concerning participants’ knowledge of BV as well as the practices they indulge in that could predispose them to the infection is summarized in Table 2; only 38% of the participants had adequate knowledge of bacterial vaginosis and up to 97% of them indulged in at least one practice that predisposes the infection.

**Table 2:** Participants’ knowledge of BV and practices that predispose them to the infection

Assessed Variable	Number of Respondents/100		Total
	Yes	No	
Knowledge of urogenital tract infection	38	62	100
Knowledge of bacterial vaginosis	38	62	100
Knowledge of BV transmission	44	56	100
Knowledge of vaginal douching	32	68	100
Knowledge of risk associated with vaginal douching	40	60	100
Practicing vaginal douching	97	3	100
Use of antiseptics in vaginal douching	43	57	100
donning air-tight pants	33	67	100

**Prevalence of Bacterial Vaginosis**

Of the 100 participants, 38 were positive for bacterial vaginosis, 34 had alteration in vaginal normal flora that was not consistent with BV while 28 were negative giving a prevalence rate of 38%. The prevalence of BV with respect to the various sociodemographic data and patients’ characteristics is presented in Table 3. Although the prevalence of BV was higher in some groups than others, no statistically significant differences were found (P-values ≥ 0.05).

**Table 3:** Prevalence of BV with respect to various sociodemographic characteristics

Patient’s Characteristic	Count/10	BV status			Statistics
		No. Negative	No. Negative with altered vaginal flora	No. Positive (%)	
Age (years)	15-19	5	2	2	$\chi^2=9.735$ P=0.464
	20-24	14	4	6	
	25-29	27	5	9	
	30-34	27	7	8	
	≥ 35	27	10	9	
Level of education	Uneducated	1	0	0	$\chi^2=4.562$ P=0.803
	Primary	55	13	19	
	Secondary	24	9	7	
	High school	14	4	5	
	Post high school	6	2	3	
Knowledge of BV and its spread	Adequate	38	12	14	$\chi^2=3.175$ P=0.529
	Inadequate	62	16	20	
Marital status	Married	62	17	19	$\chi^2=1.225$ P=0.542
	Single	38	11	15	
Pregnancy	Pregnant	59	15	17	$\chi^2=3.762$ P=0.152
	Non-pregnant	41	13	17	
Practice vaginal douching	Yes	97	25	35	$\chi^2=5.615$ P=0.06
	No	3	2	0	
Donne air-tight pants	Yes	33	8	10	$\chi^2=1.167$ P=0.558
	No	67	20	24	

**Clinical data of BV/Complications of BV**

From the data obtained, 78% participants had current or past history of bacterial vaginosis or its complications ranging from normal vaginal itches (40%), through children born with low weight (8%) to miscarriages (30%).

## Discussion and Conclusion

This study reported a prevalence of 38% for bacterial vaginosis among sexually active women in the study area. This finding is comparable to that of Spiegel (1991) in Bangladesh showing a 40-50% prevalence rate for BV. Although little or no information is available in Cameroon on bacterial vaginosis, this condition remains a major public-health problem among sexually active women in Cameroon based on our findings. This problem is made worst in pregnant women due to its sequelae and adverse effects on pregnancy and pregnancy outcome. The impact of bacterial vaginosis in pregnancy for the causation of premature rupture of membranes, preterm delivery and low birth weight is well established (Koumans *et al.*, 2001). Bacterial vaginosis is often asymptomatic, and its diagnosis is inexpensive yet needs technical skill. Failure to detect BV early constitutes a major risk factor for the acquisition of other sexually transmitted infections as previously reported (Joesoef *et al.*, 1995; Cherpes *et al.*, 2003).

We reported a higher prevalence of bacterial vaginosis among participants who attained only primary education or no education at all, those who practiced vaginal douching and those who wore tight underwear. These findings raise the need for public awareness and education on vaginal infections in general. Emphasis should be laid on proper hygienic practices as well as the bad sides of early sex, multiple sex partners, change of sex partners, use of unprescribed drugs and antiseptics amongst others.

The higher prevalence of BV among pregnant women and married women remains a major phobia. Implementation of diagnosis of BV during antenatal care especially during the second and third trimesters of pregnancy can ameliorate the condition by reducing the number or frequency of BV-associated reproductive tract infections and birth defects. However, given the complicated nature of BV diagnosis and considering the generally higher prevalence of BV among pregnant women, syndromic treatment may be an alternative. We suggest that all married women should be screened at least once a year for BV so that positive cases can be detected and treated early enough to reduce subsequent sequelae.

We, therefore, conclude that the prevalence of bacterial vaginosis in our study population is 38% and highest among women aged between 25 and 34 years, pregnant women, married women, less educated women and women who practiced poor vaginal hygiene.

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### Declaration of Competing Interests

The author(s) declare that they have no competing interests, no financial relationships with any organizations that might have an interest in the submitted work; no other relationships or activities that could appear to have influenced the submitted work.

### Author Contributions

AEA Conceived, designed, sponsored and supervised the experiments. FFF Contributed reagents and drafted the manuscript. ACA Contributed reagents and performed the experiments. ARA and AMU analyzed the data, Contributed reagents / materials / analysis tools.

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