

# Prevalence And Associated Risk Factors Of Bacterial Vaginosis Among Pregnant Women In Africa: A Systematic Review

**Gebrehiwet Tesfay**

Mekelle University College of Health Sciences

**Karthik Deekonda**

Chimertech Innovations

**Ragul Paramasivam**

Chimertech Innovations

**Saravanan Muthupandian** (✉ [saravanan.muthupandian@mu.edu.et](mailto:saravanan.muthupandian@mu.edu.et))

Mekelle University College of Health Sciences <https://orcid.org/0000-0002-1480-3555>

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## Research article

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# Abstract

**Background:** Bacterial vaginosis is the most common form of vaginitis which causes abnormal vaginal discharge in woman of childbearing age, which predispose to various gynecological and obstetric problems. In Africa sub-continent, the prevalence of BV among pregnant women is different among different countries. This review aimed to show the overall prevalence and to describe the different risk factors associated with BV among pregnant women in Africa.

**Methods:** PubMed, Medline, science direct, Google scholar and other relevant databases were searched from January 2008 to December 2018. Article retrieval and screening was done using standard procedural steps and strict inclusion/exclusion criteria. The total articles included in this review were 31 and cumulative prevalence was drawn from each country.

**Results:** This review addressed the prevalence of BV and its associated risk factors among pregnant women and its associated risk factors conducted in 31 eligible studies from 15 different countries of Africa, in which most of the studies were from Nigeria 22.6% (7/31), Kenya 16% (5/31) and Ethiopia 13% (4/31). Samples from a total of 19,354 pregnant women 4795 were positive for BV with the overall prevalence of 24.8% (4795/19,354), and the highest cumulative prevalence was reported from two studies conducted in more than two countries (1113/2349, 47.4%). Fifteen out of 31 articles or studies (48.4%) are significantly associated with different risk factors. Out of the 15 articles 33.3% (5/15) of the associated risk factors are HIV followed by age and previous BV/STI (20%).

**Conclusion:** The prevalence of BV among pregnant women was different in all regions of Africa with the pooled prevalence of 24.8%. HIV infected pregnant women and sexually active women (mostly in the age group of 20-30 years) were at high risk for BV and in some studies reported BV positive women are also at high risk of acquiring HIV infection.

## Background

Bacterial vaginosis (BV), previously termed “nonspecific vaginitis,” is the most common form of vaginitis in women and associated with overgrowth of multiple members of the vaginal anaerobic flora, genital mycoplasmas, and a small Gram-negative rod (*Gardnerella vaginalis*), once believed to be the sole cause of the disease[1]. Bacterial vaginosis (BV) is now recognized to predispose to various gynecological and obstetric problems[2]. BV is the common cause of abnormal vaginal discharge in the woman of childbearing age but may also be encountered in perimenopausal women. It is characterized by an overgrowth of predominantly anaerobic organisms (e.g., *Gardnerella vaginalis*, *Prevotella* spp., *Atopobium vaginae*, *Mycoplasma hominis*, *Mobiluncus* spp.) in the vagina leading to a replacement of lactobacilli and an increase in vaginal pH[3]. But vaginal discharge syndrome is also caused by gonorrhea, trichomoniasis, chlamydial infection, and candidiasis. BV results in a malodorous (fishy odor), homogenous, adherent to the vaginal wall, and yellowish/whitish mucoid discharge of a moderate amount[1, 4]. However, about 50 – 80% of BV positive patients are asymptomatic[5].

Any woman can get BV, but it is common in both symptomatic and asymptomatic pregnant women, and having bacterial vaginosis can increase your chance of getting any sexually transmitted diseases (e.g., Human Immunodeficiency Virus (HIV), *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and Herpes Simplex Virus Type 2 (HSV-2), complications after gynecologic surgery, complications of pregnancy, and recurrence of BV[3]. Pregnant women with BV are more likely to have babies born premature (early) or with low birth weight than pregnant women without BV and increase HIV transmission [6].

The percentage of women affected at any given time worldwide which varies between 5% and 70% and from country to country even from the same county with the most common in parts of Africa(highest in southern and eastern Africa) and least common in Asia, Europe and America[7]. In developed countries, the prevalence is lower than in developing countries. For example, in the United Kingdom, the Prevalence of *Candida albicans* and bacterial vaginosis among asymptomatic pregnant women was 12.5 and 3.54%, respectively, with almost 90% of BV positive are among the age groups of 21–30 years[8].

In Africa sub-continent, the prevalence of BV among pregnant women is different among different countries, which range from almost none to 71%[9, 10] and among the same country, which ranges from 11.9–60%[10, 11]. In addition, in Africa, there is also a wide range among HIV negative and positive pregnant women, which also ranges from almost none up to 47.8%, respectively[9, 12]. In Kenya, one out of five pregnant women attending antenatal care clinics (ANC) has a curable, sexually transmitted infection (STIs). These infections are also associated with genital ulcers, hygiene practices, early sexual debut, and bacterial vaginosis[13].

## Associated risk factors

BV is associated with having multiple male or female partners, a new sex partner, douching, a lack of condom use, and a lack of vaginal lactobacilli. BV is also associated with adverse pregnancy outcomes such as miscarriage, premature rupture of membranes, preterm birth, and low birth weight[5, 14] but there are also other complications including; Increased risk for sexually transmitted diseases(HIV, Herpes Simplex Virus, *Chlamydia*, and *Gonorrhoea*), Lower success with in vitro fertilization, Associated with tubal factor infertility and Pelvic inflammatory disease (PID)[5].

## Treatments and challenges

Treatment is recommended for all symptomatic pregnant women. Metronidazole is the most effective drug during pregnancy using the 250-mg regimen; however, metronidazole administered at 500 mg orally twice daily can also be used. Alternatively, BV among pregnant women can be treated with oral clindamycin [3].

Recurrence after recommended antimicrobial therapy is a significant problem, and about 40.3% of women develop recurrent BV following treatment[15]. Recurrent bacterial vaginosis impacts women to varying degrees, little impact on their lives, but most reporting it has a moderate to severe impact. The degree to which it impacted on women physically, emotionally, sexually, and socially often depended on

the frequency of episodes and severity of symptoms. Women commonly reported that symptoms of bacterial vaginosis make them feel embarrassed, ashamed, 'dirty,' and very concerned others may detect their malodor and abnormal discharge. The biggest impact of recurrent bacterial vaginosis was on women's self-esteem and sex lives, with women regularly avoiding sexual activity[16].

## **Methods**

### **General objective**

The aim of this review was to show the overall prevalence (including the pooled prevalence of each country and each region of Africa) and to describe the different risk factors associated with BV among pregnant women in Africa.

### **Specific objective**

To determine the pooled prevalence of bacterial vaginosis among pregnant women in Africa and to assess the risk factors associated with bacterial vaginosis among pregnant women.

### **Search strategy**

A literature search was conducted in the PubMed/ MEDLINE, science direct, PMC, and Free-text Web Searching using Google Scholar from January 2008 to December 2018. Keywords, including bacterial vaginosis, prevalence, pregnancy, risk factor, and Africa, were searched for articles published in English within ten years term (from January 2008 to December 2018).

### **Selection criteria**

All articles reporting the prevalence of bacterial vaginosis, associated risk factors, and pregnancy in the whole African region were included. Based on the abstract, articles of all types with any data on the above keywords were included for further screening. Studies were included or excluded following predefined criteria.

### **Inclusion:**

Articles on the prevalence of BV among ANC pregnant women from the African region, abstracts and full text available in English in 2008–2018 and any risk factor associated with BV (HIV negative and HIV positive pregnant women).

### **Exclusion:**

Surveys that exclusively sampled sex workers, studies conducted before 2008 and BV on menopausal women and postnatal women

### **Data extraction**

From each eligible study, data was extracted based on the following information: year and location of study, study methodology, and type of population sampled; symptomatic, asymptomatic, HIV positive and negative; method of diagnosis of BV, sample size, associated risk factors and prevalence of BV.

Data were grouped first into 5 main geographic regions (according to the United Nations geoscheme); North Africa (6), West Africa (18), Central Africa (6), East Africa (14) and Southern Africa (10) and then into all African countries.

## **Result**

### **Data and study characteristics**

In total, 1478 articles were identified. Of those, 31 studies met the inclusion criteria and were included in the final analysis. These articles/studies were selected according to the following steps:

The first step was proceeded by removing any duplicates in all records, which was followed by excluding the titles and abstracts which were not related to the prevalence of BV among pregnant women. The then, the review articles, articles out of the geographic area, and before 2008 were also removed. And then finally, full-text articles on the prevalence and associated risk factors among pregnant women from any corner of Africa are screened for eligibility by; Known prevalence, sample size, and any risk factor associated.

### **Regional prevalence of bacterial vaginosis**

#### **Intra-regional comparisons**

There is a large variety of BV prevalence among pregnant women in the same region, even in the same country in Africa (see Table 1). For example, in Easter Africa, the prevalence of BV among pregnant women ranges from none in a case-control study of 87 cases and 87 controls of pregnant women in the third trimester in Uganda to 52% among HIV-1 infected pregnant women in Kenya[9, 17], and the prevalence of BV among HIV positive pregnant women ranges from 34–52%[17–19].

#### **Inter-regional comparisons**

A higher prevalence of BV was reported from eastern Africa, with the exception of a case-control study conducted in Uganda[9], but the even higher prevalence was reported from western Africa. Especially studies reported from Nigeria show a higher prevalence of BV[10, 20], with low prevalence, which is reported from the same region in Burkina Faso[21, 22]. Two studies conducted in more than two countries also reported the highest cumulative prevalence[12, 23].

#### **East Africa**

The overall cumulative prevalence of BV in 13 studies conducted in the eastern part of Africa among all pregnant women was about 23.8%, which have the intermediate prevalence of BV in the African region

(Table 1), with the highest prevalence of BV was reported from Kenya 52%[17] then followed from Sudan 49.8%[24]. In Ethiopia, the prevalence of BV among all pregnant women (symptomatic and asymptomatic) ranges from 0.5% to 19.4[25, 26] with the cumulative prevalence of 13.8%, whereas in Kenya including HIV infected pregnant women ranges from 19.4–52%[13, 17] with the highest cumulative of 29%.

The second-highest cumulative prevalence of BV in eastern Africa was also reported from Tanzania[27, 28], with a prevalence of 21.6% next to Kenya, but a single study reported from Sudan shows a high prevalence of 49.8%[24]. However, a case-control study among women who were in the third trimester of pregnancy in Uganda, from this region also reported that none of them are not positive for BV Nugent score[9].

## **Western Africa**

There is a low cumulative prevalence of BV (15.7%) in the western Africa region with the lowest cumulative prevalence in Burkina Faso (202/2762, 7.3%) [21, 22]. But, the highest prevalence of BV was reported from a few articles in Nigeria and Cameroon[10, 20, 29]. From seven studies conducted in Nigeria, prevalence varies among pregnant women of different study participants including HIV infected, asymptomatic and symptomatic pregnant women which range from 11.9%[11] among HIV-infected pregnant women to 60% among symptomatic pregnant women[10] with a cumulative prevalence of 18.1%(Table 1).

A prospective study conducted in Ghana among pregnant women shows a prevalence of 30.9%[30], which was higher prevalence than studies conducted in Burkina faso[21, 22] and lower that of conducted in Nigeria and Cameroon[10, 20, 29].

## **Southern Africa**

The prevalence of BV among pregnant women in this region was the highest as cumulative, which gives 38.7% (Table 1), whereas individually, these studies were much lower than that of eastern and western studies. Of the four studies reported from this region, the highest prevalence of BV was reported from Zambia among the first ANC attendees in Nchelenge District with a prevalence of 48.3%[31]. But, an across-sectional study conducted in South Africa among HIV positive and negative pregnant women shows a low prevalence of BV (17.7%)[32].

## **Northern Africa**

In the Northern Africa region, only one report was included in this study, and the prevalence of BV of this report was difficult to compare to other studies conducted in other regions in Africa. This is due to small sample size(4/15, 27%)[33].

## **Studies conducted in more than two countries**

There were two (cohort and experimental) studies conducted in more than two countries in different regions of Africa. The experimental study conducted in HIV infected pregnant women in Blantyre and Lilongwe, Malawi; Dares Salaam, Tanzania; and Lusaka, Zambia shows a high prevalence of BV (1096/2292, 47.8%), with enough sample size[12], and the second cohort study conducted in Mombasa, Kenya, Kigali, Rwanda and Johannesburg, South Africa, reports a prevalence of 30%[23]. The second cohort study conducted in sub-Saharan Africa shows a low prevalence of BV with too small sample size.

Table 1

Characteristics and results of studies (n = 31) reporting the prevalence of BV among pregnant women in Africa

Africa continent		Articles by Author, year and reference	Location of the study	Type of study and participants	Prevalence & sample size	Techniques used
Regions	Countries					
East Africa	Ethiopia	Mengistie et al., 2014[26]	Tikur Anbessa University Hospital	A cross-sectional study among symptomatic and asymptomatic women	19.4% (49/252)	Nugent criteria
		Ayenalem et al., 2010[34]	Institute of Pathobiology, Addis Ababa University	A cross-sectional study among symptomatic women	18% (2/11)	Nugent criteria
		Mengistie et al., 2013[35]	Tikur Anbessa University Hospital	A cross-sectional study among symptomatic and asymptomatic women	19.4% (Nugen) & 18.3% (Amsel) (49/252)	Nugent criteria & Amsel's criteria

BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1

	Mulu et al., 2015[25]	Felegehiwot referral Hospital	A cross- sectional study among the symptomatic and asymptomatic reproductive age group	0.5% (1/214)	Wet mount and gram reaction
The total prevalence of BV in Ethiopia				101/729 = 13.8%	
Kenya	Marx et al., 2011[19]	Antenatal clinics in Nairobi	Nested and prospective cohort study among HIV-1- infected pregnant women	37% (156/421)	Nugent criteria
	Slyker et al., 2014[18]	Nairobi antenatal clinics	Retrospective analysis of cohort study among pregnant HIV- infected women	37% (144/385)	Nugent criteria

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	Farquhar et al., 2011[17]	Kenyan Medical Research Institute	A prospective cohort study among HIV-1-infected Kenyan pregnant women & infants	59% (52/88) for in utero transmitters & 35% (13/37) who did not (65/125) = 52%	Nugent criteria
	KINUTHIA et al., 2015[36]	Ahero and Bondo maternal child health clinics	Prospective cohort study among HIV-seronegative pregnant women	23% (300/1304)	Nugent criteria
	Masha et al., 2017[13]	Kilifi County Hospital	A cross-sectional study among pregnant women	19.4% (39/202)	Nugent criteria
	Total prevalence of BV in Kenya			704/2437 = 29%	
Sudan	Abdelaziz et al., 2014[24]	Omdurman Maternity Hospital	A cross-sectional study among symptomatic and asymptomatic women	49.8% (99/200)	Nugent, Amsel & culture

BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1

	Tanzania	Msuya et al. 2009[27]	Two primary health care clinics in Moshi (Majengo and Pasua)	A cohort study among pregnant women attending routine antenatal care	20.9% (555/2654)	Amsel's criteria
		Shayo et al., 2012[28]	Bugando Medical Centre	A cross-sectional descriptive study among pregnant women	28.5% (81/284)	Nugent criteria
	Total prevalence of BV in Tanzania				636/2938 = 21.6%	
	Uganda	Nakubulwa et al., 2015[9]	New Mulago hospital	Unmatched case-control study among women who were in the third trimester of pregnancy	None (0%) None in 87 cases and 87 controls	Nugent criteria
	Total pooled prevalence of BV in east Africa				1540/6478 = 23.8%	
West Africa	Nigeria	Imade et al., 2015[11]	Jos University Teaching Hospital	A cross-sectional study among HIV infected pregnant women	11.9% (470/3950)	Wet mount and gram reaction
BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1						

Victor et al.2017[20]	Taraba State Specialist Hospital	A cross-sectional study among all pregnant women attending antenatal care clinic for the first time	56.6% (51/90) (Amsel) & 45% (41/90) (Hay/ison)	Amsel and Hay/ison criteria
Awoniyi et al. .2015[10]	Primary health care clinic at Enuwa, Ille-Ife, Osun State	A cross-sectional study among symptomatic pregnant women	60% (90/150) by Nugent 33% (50/150) by Amsel	Nugent and Amsel's criteria
Asiegbu et al. .2018[37]	Antenatal clinic of the Federal Teaching hospital	A prospective study among symptomatic and asymptomatic pregnant women	23.9% (55/230)	Amsel's criteria
Afolabi et al. .2016[14]	Lagos University Teaching Hospital	A prospective observational study among symptomatic pregnant women	26% (64/246)	Nugent score criteria
Adelaiye et al. 2015[38]	ABUTH(Ahmadu Bello University Teaching Hospital)	A case-control and laboratory-based study among HIV positive and negative pregnant women	33.2% (133/400) but for HIV + ve it is 46% (92/200)	Amsel's criteria

BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1

		Olowe et al. .2014[39]	Ladoke Akintola University of Teaching Hospital	A descriptive cross- sectional study among pregnant women	38% (38/100)	Nugent score criteria
Total prevalence of BV in Nigeria					901/4966 = 18.1%	
Ghana		Konadu, 2015[30]	Kintampo Municipal Hospital.	A prospective study of pregnant woman	30.9% (182/589)	Nugent score criteria
Burkina faso		Kirakoya- samadoulo ugou et al.2008[21]	Four provinces of Burkina Faso (Boulgou, Poni, Seno, and Yatenga)	A national survey among pregnant women	6.4% (146/2284)	Nugent score criteria
		Brabin et al. .2017[22]	Nanoro Health and Demograp hic Surveillanc e	Randomize d, double- blind, controlled trial	11.7% (56/478)	Nugent score criteria
The total prevalence of BV in Burkina Faso					202/2762 = 7.3%	
Cameroon		Achondou et al. 2016[29]	CDC Central Clinic, Tiko	A cross- sectional study among sexually active, pregnant and non- pregnant women	45.8% (27/59)	Nugent score criteria
Total pooled prevalence of BV in western Africa					1312/8376 = 15.7%	
North Africa	Algeria	Souad Alioua et al. .2016[33]	Hospital Abdallah Nouaouria	A cohort study among pregnant women	27% (4/15)	Nugent score criteria

BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1

Southern Africa	South Africa	Redelinghuys MJ, et al. .2015[32]	Medical Microbiology, University of Pretoria	A descriptive, Cross-sectional study among HIV + ve and - ve pregnant women	17.7% (39/220) but among HIV = 25% (9/36)	Nugent score criteria
	Zimbabwe	Kurewa et al. .2010[40]	Three peri-urban clinics around Harare Zimbabwe	A cross-sectional study among pregnant women	32.6% (225/691)	Amsel's criteria;
		Turner et al. .2016[41]	University of Zimbabwe	A prospective cohort study Among healthy, urban, Zimbabwean women	27% (38/141)	Nugent criteria
	Total prevalence of BV in Zimbabwe				263/832 = 31.6%	
Zambia	Chaponda et al. 2016[31]	Two health centers, Nchelenge and Kashikishi, in Nchelenge District,	A prospective cohort study among pregnant women	48.3% (524/1084)	Nugent criteria	
Total pooled prevalence of BV in southern Africa				826/2136 = 38.7%		
Studies conducted in more than two countries	Aboud et al. .2009[12]	Blantyre and Lilongwe, Malawi; Dares Salaam, Tanzania; and Lusaka, Zambia	A randomized, double-blinded, placebo-controlled Phase III trial among HIV-infected pregnant women	47.8% (1096/2292)	Nugent criteria	

BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1

	Jespers et al. 2014[23]	Mombasa, Kenya, Kigali, Rwanda, and Johannesburg, South Africa	A cross-sectional cohort study among different groups	30% (17/57)	Nugent criteria
	The total pooled prevalence of BV in the two studies			1113/2349 = 47.4%	
	The total pooled prevalence of BV among HIV infected African pregnant women			2032/7409 = 27.4%	
Total	31 articles in Africa			4795/19,354 = 24.8% (pooled prevalence of BV)	
BV = Bacterial Vaginosis, HIV = Human Immunodeficiency Virus, HIV-1 = Human Immunodeficiency Virus-type 1					

### Associated risk factors for BV

Fifteen out of 31 articles or studies (48.4%) conducted in Africa on the prevalence of BV and their associated risk factor among pregnant women shows a significant association with different risk factors. Out of the 15 articles, 33.3% (5/15) of the associated risk factors were HIV, followed by age and previous BV/STI (20%) (Table 2).

## HIV

HIV was the most associated risk factor reported from seven articles and five different countries in different regions of Africa, with the overall prevalence of BV among HIV infected pregnant women of 27.4%, which is higher than of cumulative prevalence in Africa (24.8%) (Table 1). In east Africa, two studies conducted in Kenya[17, 36] and one study from Tanzania[27] reported that BV was significantly associated with HIV infection. For example, according to *Kinuthia et al.* 2015, from Ahero sub-District and Bondo District Hospitals in rural western Kenya, among pregnant women, BV was associated with approximately 3 fold increased risk of acquiring HIV[36].

Two articles from the western Africa region, Nigeria, and one from the southern Africa region, South Africa, also reported that BV was significantly associated with HIV infection[11, 32, 38]. Case control and laboratory-based study conducted in Ahmadu Bello University Teaching Hospital, Zaria, Nigeria among both HIV positive and negative pregnant women reported that prevalence of BV In HIV-positive pregnant women was 46.0% whereas in HIV-negative pregnant women, the prevalence was 20.5% and HIV-positive pregnant women are significantly more likely to have BV[38].

In South Africa, a study conducted by Redelinghuys MJ et al. 2015, among pregnant women at the antenatal clinic of a tertiary academic hospital, revealed that BV was inversely associated with

gestational age. however, BV was significantly associated with HIV infection[32].

## Age

A cross-sectional study on the prevalence of BV, conducted in CDC central clinic, Tiko, Cameroon, among sexually active pregnant and non-pregnant women aged 15–45 years shows a total prevalence of 38% (38/100) and among pregnant women 45.8% (27/59), which was more prevalent among pregnant women. In addition, this study investigated that BV was more prevalent in the age group of 20–25 years(48.1%) followed by 25–29 years(44.4%), and age shows a significant association with BV[29].

Another study that shows age as a significantly associated risk factor with BV was reported from Ghana by *Konadu*, 2015 on the prevalence of BV, trichomoniasis, and candidiasis among pregnant women. This report revealed that 50.55%(92/182) of the BV positive pregnant women were in the age group of 21–30 years followed by less than 20 years of age, with a prevalence of 29.67%(54/182) [30].

In Ethiopia, a study conducted in Felegehiwot referral hospital, on Common causes of vaginal infections and antibiotic susceptibility of aerobic bacterial isolates in women of reproductive age(pregnant and non-pregnant), reported that BV was higher among non-pregnant women(11/195, 5.6%) than pregnant women(1/214, 0.5%) and significant association was seen in the age group of 40–49 years[25].

Table 2

Risk factors associated with bacterial vaginosis (n = 16) among pregnant women in African

Risk factors	Frequency/pooled risk factor	references
Age	3	[25, 29, 30]
Religion	3	[21, 25, 38]
Education	2	[29, 37]
Marital status	2	[21, 29]
Multiple LTSP	2	[20, 26]
Gestational age	1	[32]
Residence	1	[25]
Number of pregnancy	1	[30]
History of abortion	2	[21, 26]
Preterm delivery	1	[14]
Low birth weight	1	[14]
premature rupture of membranes	1	[14]
Previous BV/STI	3	[13, 20, 21]
Douching	1	[13]
Vaginal discharge	2	[29, 30]
Contraceptive use	1	[23]
HIV	6	[11, 17, 27, 32, 36, 38]
Total		16/31 = 51.6%
BV = Bacterial Vaginosis, LTSP = Life Time Sexual Partner, STI = Sexually Transmitted Infection, HIV = Human Immunodeficiency Virus		

## Discussion

A comparison among different regions in Africa was made by Prevalence of BV among pregnant women. However, there were many factors that hampered comparisons among different studies (HIV positive or negative, symptomatic or asymptomatic and test method used). Despite these difficulties, cumulative prevalence within the same country or across country and comparison based on the same test method was conducted in this review. Generally, the prevalence of BV among pregnant women was considerably higher in the African continent.

This review addressed the prevalence of BV and its associated risk factors among pregnant women and its associated risk factors conducted in 31 eligible studies from 15 different countries of Africa, in which most of the studies are from Nigeria 22.6% (7/31), Kenya 16% (5/31) and Ethiopia 13% (4/31)(Table 1).

Samples from a total of 19,354 pregnant women and from all 31 eligible studies from January 2008 to December 2018, 4795 were positive for BV with the overall prevalence of 24.8% (4795/19,354) (Table 1), with the highest cumulative prevalence was reported from two studies conducted in more than two countries in Africa (1113/2349, 47.4%) and high among HIV infected pregnant women, 1096/2292, 47.8%)[12, 23] and followed by Southern regions of Africa (826/2136, 38.7%) with the highest prevalence from Zambia (524/1084, 48.3%)[31] .

The majority of the studies were from the East Africa region (13/31, 41.9%), while the smallest number of studies were from the Northern African region (1/31, 3.2%) (Table 1). No suitable report was obtained from the region of central Africa. Most of the studies (15/31, 48.4%) were cross-sectional studies, and almost all studies (24/31, 77.4%) are diagnosed using the Nugent scoring system. Individually, the highest prevalence of BV (60%) was reported from Nigeria, the western region of Africa, among symptomatic pregnant women using Nugent score[10] whereas the lowest prevalence was reported from Uganda, the eastern region of Africa, among pregnant women who are in the third trimester of pregnancy with all of them are negative for Nugent score 7–10 to classify as BV positive[9].

The prevalence of BV was generally high among HIV infected pregnant women as compared to HIV negative pregnant women, with the prevalence of 52%[17], 47.8%[12], 46%[38], 37%[18], 37%[19], 25%[32] and 11.9%[11] in which most of the studies were from Kenya and Nigeria.

The geographical distribution of BV among pregnant women in African countries shows that there was substantial difference in prevalence among different countries in Africa. For, example, studies conducted from eastern regions of Africa reported the highest prevalence of 52% from Kenya[17], which was followed by a study reported from Sudan, 49.8%[24]. However, few studies from the eastern part of Africa also reported a very low prevalence of BV from studies reported especially from Uganda[9] and Ethiopia[25]. High prevalence of BV was reported not only from the eastern region but also from the western region (highest prevalence's from Nigeria (56.6% and 60%)[10, 20] and Cameroon (45.8%)[29]) and southern regions of Africa with the highest prevalence reported from Zambia 48.3%[31].

Risk factors significantly associated with BV were; HIV[11, 17, 27, 32, 36, 38] (Table 2), age [25, 29, 30], previous BV/STI [13, 20, 21], history of abortion [21, 26], number of LTSP [20, 26], gestational age [32] and douching [13]. Whereas complications associated with BV were also Preterm delivery, Low birth weight, and premature rupture of membranes[14]. Among pregnant women with a history of STI significantly associated with BV were; HSV-2[21], polygamist (multiple sexual partners)[20], and genital ulcer[13]. And women who used water for cleaning after visiting the toilet were vulnerable to BV as compared to those who used toilet paper or other solid means[13].

Pregnant women who had a history of abortion, especially spontaneous history of abortion and with the early stages of pregnancy, were at high risk of being BV positive and some studies indicated that women in the early stages of pregnancy and history of abortion were significantly associated with BV[21, 26, 32].

## Conclusion

The prevalence of BV among pregnant women was different in all regions of Africa, with high prevalence were reported from two studies conducted in more than two countries (especially higher prevalence's were reported from Nigeria and Kenya). In this review, the pooled/total prevalence of BV among pregnant women in Africa was 24.8%.

The most significantly associated risk factor was HIV, with a prevalence of 27.4% among HIV infected pregnant women, which was higher than the total prevalence (24.8%). Prevalence of BV among pregnant women in Ethiopia was comparable to reports from Tanzania but low as compared to prevalence's reported from the same region in Kenya. But the higher prevalence of BV was reported from the southern and western regions of Africa with the highest prevalence were reported from Nigeria. HIV infected pregnant women and sexually active women (mostly in the age group of 20–30 years) were at high risk for BV, and in some studies reported BV positive women were also at high risk of acquiring HIV infection.

## Recommendations and limitations

**Firstly**, this study was focused on the prevalence of BV irrespective of the test method used even most of them were done using the Nugent scoring system.

**Secondly**, the review tried to cumulate the average prevalence between different regions and countries of Africa and the different statuses of the study participants (symptomatic, asymptomatic, and HIV positive and negative pregnant women).

**Thirdly**, no suitable or eligible report was identified from the region of central Africa.

**Finally**, the number of participants or pregnant women from different regions of Africa were not proportionate to draw regional cumulative prevalence. This was because of the prevalence of BV from one report from the northern region of Africa was difficult to compare with the cumulative prevalence of 13 studies from eastern Africa.

## Abbreviations

ANC Antenatal Care

BV Bacterial Vaginosis

CDC Centre for Disease Control and Prevention

HIV Human Immunodeficiency Virus

HSV-2 Herpes Simplex Virus-2

HIV-1 Human Immunodeficiency Virus Type-1

LTSP Life Time Sexual Partner

STIs Sexually Transmitted Infection(s)

STDs Sexually Transmitted Disease(s)

PID Pelvic Inflammatory Disease

## Declarations

Ethics approval and consent to participate

Not Applicable

Consent for publication

Not Applicable

Availability of data and materials

The datasets generated during and/or analyzed during the current study are available in the PubMed, Medline, Science Direct, Google Scholar.

Competing interests

The authors declare that they have no competing interests".

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Authors' contributions

All the authors have equally contributed to the manuscript during the collection of data and interpretation of the results.

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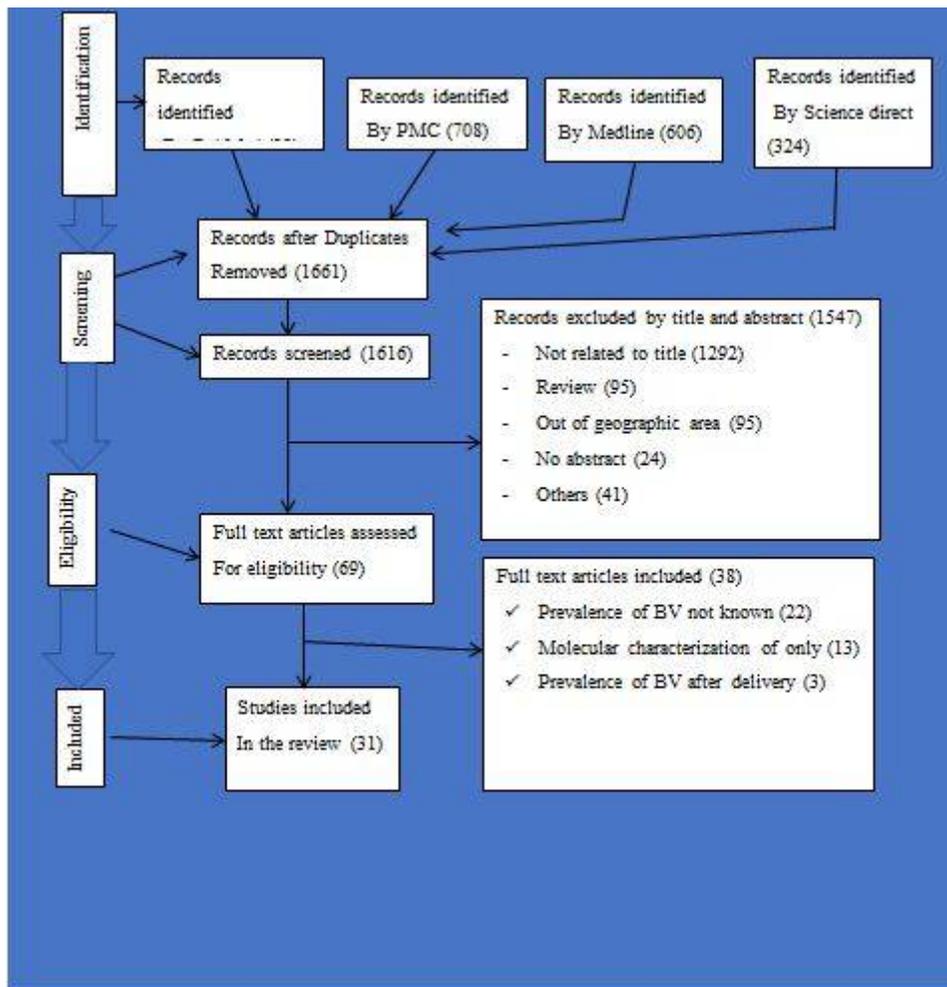
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## Figures



**Figure 1**

PRISMA Diagram of the article selection procedure for articles published between 2008 and 2018.