

Research Article

Gardnerella-associated Vaginosis Among Women of Child-Bearing Age Attending a Tertiary Hospital-Cameroon: Prevalence and Predicting Factors

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Abstract

Background: *Gardnerella vaginalis* being one of the major causes of bacterial vaginosis poses serious health problems by causing damage to the vaginal epithelial cells and disrupt the protective barrier of the mucosa, thereby increasing susceptibility to sexually transmitted diseases, and complications during pregnancy. **Objective:** This descriptive cross-sectional study was aimed at determining the prevalence and predicting factors for the occurrence of Gardnerella-associated vaginosis among women of reproductive age attending a tertiary hospital in Cameroon. **Methods:** The study was performed on 200 women, randomly selected and of reproductive age, who attended the Buea Regional hospital from April to June 2024. A well-structured and pretested questionnaire was used to obtain demographic and clinical data from volunteers. Sterile swabs were used to collect vaginal samples which were inoculated on Colombia agar with 5% sheep infusion and incubated at 37°C for 24 hours. Gram staining, microscopy, biochemical testing and presence of Clue cells were used to identify *Gardnerella vaginalis* infection. Statistical analyses were performed using the SPSS version 22.0 and Odd Ratios to determine the relationship among variables at a significance level $P < 0.05$. **Results:** Results showed that 124 cases were positive for *Gardnerella vaginalis* infection (62.0%). The mean age of participants was 25.15 ± 0.731 years and patients between 16-25 years recorded the highest prevalence (39%) of *Gardnerella vaginalis* infection. Socioeconomically, unemployed participants showed the highest prevalence (65.3%), although the difference was not significant ($P = 0.49$). Abnormal vaginal discharge was significantly ($P = 0.02$) associated with the highest prevalence (75%) among other clinical parameters. This study revealed significant associations of the use of antiseptic soap while douching (OR: 4.92; 95% CI: 1.4–13.66; $P = 0.026$), being sexually active (OR: 2.88; 95% CI: 1.1-10.06; $P = 0.04$), as well as diabetes (OR: 3.13; 95% CI: 1.99–9.43; $P = 0.041$) and regular intake of anti-inflammatory drugs (OR: 4.01; 95% CI: 1.2-13.01; $P = 0.038$), which strongly predicted occurrence of *Gardnerella vaginalis* infection. **Conclusion:** Mindful of the above analyses, it is important that women of reproductive age must be promptly checked for bacterial vaginosis and determine predicting factors for its occurrence, which will help policy makers to put in place appropriate preventive and treatment measures to curb complications during pregnancy and transmission of STDs.

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Received: 17 October 2024; **Accepted:** 11 November 2024; **Published:** 21 November 2024



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Keywords

Antiseptic Soap, Cameroon, Douching, *Gardnerella*-associated Vaginosis, Prevalence, Predicting Factors, Tertiary Hospital

1. Introduction

Bacterial vaginosis is a common female reproductive tract disorder, which continues to cause devastating health consequences among women of child bearing age, accounts for one third of vaginal infections globally [1] and its prevalence has shown to vary in parts of Africa [2] and notably in Cameroon.

Gardnerella Associated Vaginosis (GAV) is one of the causes of bacterial vaginosis associated with complications due to urinary tract infections (UTIs), pelvic inflammatory disease (PID), vaginal cuff cellulitis, tubal infertility, cystitis, and abortion [3] because of depleting levels of lactobacilli and infection of epithelial cells causing inflammation [4]. This has resulted in 10 million clinical visits every year [5] especially in low resource countries, where 17.02% of vaginal infections was recorded among women at the District Hospital of Dschang, West Region, Cameroon [6].

Gardnerella vaginalis has been isolated from vaginal swabs obtained from nearly all women having vaginosis due to bacterial infection [7] and is a facultative anaerobe found in less than 1% of cases in women's normal vaginal flora. It is a Gram-negative to Gram-variable coccobacillus with pleomorphic rods that are nonmotile.

The causes of nonspecific vaginal discharge or bacterial vaginosis are different, but the most common causes are anaerobic microorganisms, including bacteria, fungi, and parasites [6]. The normal vaginal flora is mainly composed of facultative anaerobic organisms such as *Lactobacilli* [4] and colonization of the vagina by *Gardnerella vaginalis* does not all the time cause vaginosis [8]. However, *Gardnerella vaginalis* possesses a number of virulence factors including production of enzymes which can break down the vaginal mucus and expose the underlying epithelium to other pathogens [4] and disrupt the protective barrier of the mucosa [9]. They affect the microbiome of the vagina causing symptoms such as itching, malodorous greyish or greenish vaginal discharge with a fishy odor, burning sensation during urination, and pain during sex [10], which characterizes the presence of clue cells, few or no *Lactobacilli*.

A shift in the vaginal microflora from a *Lactobacillus*-dominated environment to a state of depletion of *Lactobacillus* combined with the overgrowth of anaerobic and microaerophilic bacterial species either singly or in combination [11] such as *Gardnerella vaginalis*, *Mycoplasma hominis*, *Bacteroides ureolyticus*, etc [12], defines bacterial vaginosis (BV) [4]. Several factors can alter the vaginal flora including the patient's age, level of sexual activity, hormonal conditions, douching and health status [10] and can lead to a change in

vaginal pH [6]. When the environment of the vagina alters, it encourages the bacterial population, enhances their adherence to epithelial cells of the vagina, and facilitate the formation of clue cells. These changes may transform asymptomatic colonization into symptomatic *Gardnerella* infection [13].

It is evident in Cameroon that vaginal infections and their complications have led to setbacks in the socioeconomic life of the population such as abortion, malformation and death of fetus, childlessness, increasing medical and funeral bills, lack of efficiency at work or absenteeism from work, lack of vibrant staff leading to low productivity, and increasing hardship and poverty [6]. Although several studies on GAV have been conducted in Africa, there is paucity of data from Cameroon, with regard to predicting factors associated with the occurrence of the disease among women of reproductive age in Buea, South West region of Cameroon.

In consideration of the elaborative challenges, the aim of this study was to determine the burden of *Gardnerella vaginalis* infection and risk factors for its occurrence, in reproductive age women attending a tertiary health facility in Cameroon.

2. Materials and Methods

2.1. Study Design

A descriptive cross-sectional study was carried out in Buea Regional Hospital Annex, a tertiary hospital located in Buea of the South West region of Cameroon, from April to June 2024. Vaginal swabs were collected at the microbiology laboratory for culture and microscopy, and a questionnaire was used to obtain additional data to complement the study.

2.2. Procedure for Data and Sample Collection and Processing

After obtaining administrative authorization to carry out research (Appendix: Figure 4), the questionnaire was pre-tested and all modifications done, and then administered to those who signed the informed consent form to fill or read for those who couldn't read.

A total of 200 participants were randomly selected to take part in the study, which included women of reproductive age, who were not on antibiotic treatment within the last 48 hours

and excluded women who were in their period of menstruation, below reproductive and menopausal ages.

The patient lied down on the back for appropriate collection. A sterile speculum was used to separate the walls of the vagina and to make expose the vaginal fornix and three swabs were collected containing vaginal discharges from the endocervix and walls of the vagina. The swabs containing the discharges were then placed in swab vacuum to avoid contamination, and immediately transported to the bacteriology laboratory of the Buea Regional hospital and used for Whiff test, Gram staining and microscopic observation for clue cells on slides, culture and biochemical testing.

2.3. Identification of *Gardnerella vaginalis* and Culture Procedure

The Whiff test was performed which followed standard procedures described [15] to presumptively identify the presence of *Gardnerella vaginalis* where one of the swabs was used and sample from it was put on the glass slide. Two drops of 10% KOH solution were added to the sample on the slide and mixed using a sterile loop. A characteristic amine or fishy smell when exposed to 10% KOH was inhaled which was presumptively diagnostic of *Gardnerella vaginalis*.

A smear was then made on a glass slide using another swab and Gram staining was carried out following standard procedure. Clue cells (epithelial cells invaded by gram variable coccobacilli clustered together in short chains or pairs) seen on the gram-stained slide observed under oil immersion microscope was diagnostic of *Gardnerella vaginalis* infection, a hallmark of vaginosis.

One of the swabs containing the sample was used for culture on Columbia agar [14] infused with 5% sheep blood. After streaking the sample on the culture medium, the plate was incubated at 36°C in a carbon dioxide environment using an anaerobic jar (5-10% CO₂). After incubation for 24 hours, *Gardnerella vaginalis* appeared as small greyish colonies on the agar plate. Colonies were further identified using Gram staining and biochemical tests such as oxidase, catalase, motility, Indole, carbohydrate fermentation, urease.

2.4. Data Management and Analysis

Data were analyzed using the statistical package SPSS version 22.0. The chi-square test and odd ratio values were used to determine relationship among variables at a significant level of $P < 0.05$.

3. Results

Overall prevalence of *Gardnerella vaginalis* infection among study participants.

This study consisted of 200 women attending the Buea Regional Hospital. The age range of the participants was from 16 to 55 years. In this study 124 out of 200 participants

(62.0%) were positive for *Gardnerella vaginalis* infection with presence of clue cells (Figure 1). There was a significant difference in the overall prevalence of *Gardnerella vaginalis* infection ($P < 0.05$) (Figure 2).

Prevalence of Gardnerella vaginalis infection with respect to Age

The mean age of participants was 25.15 ± 0.731 . Women in age range 16-25 years had a significant ($P < 0.05$) highest prevalence of 39.0%, those in the age range 26-35 years recorded a prevalence of 16%, and participants between the ages 36-45 years had 4%, while women greater than 45 years had the least (3.0%) (Figure 3).

Prevalence of Gardnerella vaginalis infection considering Socio-economic status

In this study, women who were single had a higher prevalence of 65.5% than those who were married (57.1%). Participants who were unemployed had the highest prevalence (65.3%) than those employed (50%) or self-employed (62.7%). Those of other religions apart from Catholic, Protestant and Muslim recorded the highest prevalence (80%). Participants with tertiary level of education registered a prevalence of 58.9%, while those with no formal level of education had 69.2% (Table 1), although there was no significant difference ($P > 0.05$) in the prevalence values.

Prevalence of Gardnerella vaginalis infection in patients with and without symptoms

For participant who had itches, 56 were positive for *G. vaginalis* infection giving a prevalence of 68.3%, while those without itches recorded 57.6%. Participants who presented with abnormal discharge had a prevalence of 75%, while those without abnormal discharge had 50%. Women with a burning sensation while urinating had a prevalence of 72.2%. There was a significant difference in the prevalence recorded ($P < 0.05$) (Table 2).

Determination of Risk factors associated with Gardnerella vaginalis infection

In this study, participants who did not use antiseptic soap while douching had a prevalence of 57.5%, while an 80% prevalence for *Gardnerella vaginalis* infection was recorded for those who used antiseptic soap during douching and the association was significant (OR: 4.92; 95% CI: 1.4–13.66; $P < 0.05$) (Table 3). Participants who ironed their pants before wearing had a prevalence of 57.9%, while participants did not iron their pants registered 62.9%, although there was no significant association (OR: 2.6; 95% CI: 0.89–4.52; $P > 0.05$) (Table 3). With respect to the number of people that used the same toilet, the highest prevalence (64.4%) was recorded for participants who shared a single toilet with more than two persons than those who shared with just two persons or did not share with any, but the association was not significant (OR: 1.55; 95% CI: 0.68–4.11; $P > 0.05$).

Furthermore, participants who used cotton pants had a prevalence of 62.5%, while those who used nylon pants recorded 60% and statistically, there was no significant association (OR: 0.72; 95% CI: 0.19–2.15; $P > 0.05$) (Table 3).

Sexually active participants, had a prevalence of 67.1% higher than women who were not sexually active (48.1%) and the association with *Gardnerella vaginalis* infection was significant (OR: 2.88; 95% CI: 1.1-10.06; $P < 0.05$).

Women who regularly took anti-inflammatory drugs, had a prevalence of 70.0% for *G. vaginalis* infection, while those who did not take anti-inflammatory drugs recorded 58.6%, and this factor produced significant association with the occurrence of *G. vaginalis* infection (OR: 4.01; 95% CI: 1.2-13.01; $P < 0.05$) (Table 3).

For Sexual activity, the prevalence was 67.1% in sexually active participants, compared to 48.1% in those not sexually active. There was a significant association with the occurrence of *Gardnerella vaginalis* infection (OR: 2.88; 95% CI: 1.1-10.06; $P < 0.05$) (Table 3).

The prevalence of *Gardnerella vaginalis* infection in women who were exposed to STDs initially was higher (63.9%) than in those who were not exposed before (58.9%), although there was no statistically significant association (OR: 1.44; 95% CI: 0.59-4.01; $P > 0.05$) (Table 3).

4. Discussion

This research was carried out to isolate and identify *Gardnerella vaginalis* from vaginal samples collected from women of reproductive age who attended the Buea Regional Hospital, a tertiary health facility, to determine the prevalence and factors associated with the occurrence of vaginosis due to *G. vaginalis*. The methods employed were sensitive enough in the isolation of the bacteria and identification of the infection in a standard health facility. The overall prevalence of *Gardnerella vaginalis* infections was 62.0% (Figure 2). This finding is lower than those registered by authors in previous studies [16, 17], who found a prevalence of 70.5% and 68.7% respectively. Our prevalence is higher than the 15.4% reported in Ethiopian women of childbearing age [18]. These differences may be related to differences in study populations and the diagnostic performance of the tests used.

This study recorded an average participants' age of 25 years. A high prevalence of 39.0% was recorded amongst female students between the ages of 15-25 yrs (Figure 3). This prevalence differs with the findings of another study [19]. The high prevalence in this study among these young ladies is perhaps due to sexually activities or probably due to little or inadequate knowledge on how their vagina environment should be, hence a higher incidence of *G. vaginalis* infection. This supports the findings of a study [20] who reported that women between the age group of 15-30 yrs were the most infected. Although *Gardnerella vaginalis* is not necessarily called a sexually transmitted infection, it cannot be disputed that sexual activity can enhance its acquisition.

Furthermore, findings of this study showed that women who were employed had a prevalence of 50%, lower than that recorded in women who were unemployed (65.3%) and self-employed (62.7%), although there was no significant

difference ($P > 0.05$) (Table 1). This study corroborates with that of a study [21] which indicated that women with stable employment had low prevalence rate. The stable income and possibly better access to healthcare might contribute to this lower prevalence. The lack of employment might be associated with reduced access to healthcare and lower health literacy, contributing to higher infection rates. The prevalence rate recorded among self-employed participants was in agreement with results of a study reported [22], who found that women with irregular income sources, including self-employment, had higher rates than those employed. This might be due to inconsistent healthcare access and varying levels of stress related to self-employment.

Women who complained of itches, 56 were positive for *G. vaginalis* infection (68.3%). Participants who presented with abnormal discharge had prevalence of 75%, while those without discharge recorded 50% prevalence rate (Table 2). There was a significant difference in the prevalence recorded ($P < 0.05$). This study contradicts that of a study [23] who reported a lower prevalence of infection with abnormal discharge (40%), while those without discharge showed a much lower prevalence (15%). This study is also contradictory to reports obtained from another study [23], who reported a prevalence of 35% among women with no present symptoms of bacterial vaginosis, suggesting that absence of clinical signs and symptoms may not determine current prevalence rates. There may be an infection of vaginal epithelial cells by *Gardnerella vaginalis* even when no clinical signs of vaginosis are present and vice versa. The equal prevalence in our study may indicate a high rate of asymptomatic carriage, which contrasts with typical findings emphasizing symptomatic associations.

Participants with a burning sensation while urinating had a prevalence of 72.2% for *Gardnerella vaginalis* infection, whereas those without burning sensation had a prevalence of 56.3% (Table 2). This study is contradictory to another finding [23], which reported that for symptomatic vaginosis, including burning sensation during urination, the prevalence rate was lower compared to asymptomatic cases. The higher prevalence in symptomatic participants in our study suggests a significant rate of subclinical infections and possibly differences in study participants and the accuracy of diagnostic techniques used [19].

Results obtained from our study on the relationship between sexual activity and the occurrence of *Gardnerella vaginalis* infection showed that the prevalence among sexually active participants was 67.1%, higher than values obtained in those who were not sexually active (48.1%). There was a significant association with the occurrence of *Gardnerella vaginalis* infection (OR: 2.88; 95% CI: 1.1-10.06; $P < 0.05$) (Table 3). This finding corroborates with that of a previous study [24] that had a prevalence of approximately 50% in sexually active women, significantly higher than the 10-20% in those who were not sexually active. This confirms the strong association between sexual activity and *Gardnerella*

vaginalis infection seen in our study. In women of childbearing age, during the period of active vaginal activity, vaginal infection is one of the most occurring diseases [25]. This could be due to the fact that many of such women may have many sex partners [6] with poor personal hygiene and hardly use condoms. Vaginosis can develop because of the alkalinity of the sperm which reduces vaginal acidity and cause infection. Such women may not be well educated on the need for proper routine douching principles and safe sex approaches.

The prevalence of *Gardnerella vaginalis* infection among participants who had prior exposure to STDs was higher (63.9%) compared to those who were not exposed (58.9%), although there was no statistically significant association (OR: 1.44; 95% CI: 0.59–4.01; $P>0.05$). This result was not in accordance with a reported finding [3] that women with a history of STDs had a higher prevalence (45–50%), compared to 20–30% in those without such a history, suggesting possible differences in the population or study design. Furthermore, our study contradicts that of a study [26] who found that vaginosis was more common among women with a history of STDs. The higher prevalence in our study among those exposed to STDs might indicate ineffective management of STDs or differences in sexual health practices in the study population.

The prevalence of *Gardnerella vaginalis* infection was 77.8% among diabetic participants and 60.4% among non-diabetic participants, and the association was statistically significant (OR: 3.13; 95% CI: 1.99–9.43; $P=0.041$). Our result is partially in accordance with that recorded in another study [27] that showed a positive correlation between diabetes and increased vaginosis prevalence, although with lower prevalence rates, suggesting possible differences in healthcare access, management of diabetes, or study population characteristics. Our finding also corroborates with those recorded by other researchers [10] indicating that diabetic women were at a higher risk for vaginosis, with higher prevalence rates in diabetic patients compared to non-diabetic women. The higher prevalence among diabetic participants in our study might be due to increasing glucose content which could affect pH in vaginal secretions [6] and favors the overgrowth of *Gardnerella vaginalis* causing infection.

This study showed that participants who did not use anti-septic soap while douching had a prevalence of 57.5%, while 80% prevalence for *Gardnerella vaginalis* infection was recorded for those who used antiseptic soap during douching and the association was significant (OR: 4.92; 95% CI: 1.4–13.66; $P<0.05$) (Table 3). This result is not supported by another study [28] which showed no relationship. The association produced could be due to that fact that antiseptic soap tends to destroy the vaginal flora, thus, distorting vaginal pH, causing *Gardnerella vaginalis* to overgrow and cause bacterial vaginosis infection [6].

With respect to the number of people that used the same toilet, the highest prevalence (64.4%) was recorded for par-

ticipants who shared a single toilet with more than two persons than those who shared with just two persons or did not share with any, but the association was not significant (OR: 1.55; 95% CI: 0.68–4.11; $P>0.05$). This is in agreement with study carried out by Payne and colleagues [6]. This could be explained by the fact that microorganisms are still alive on toilette seats, as well as in bathing water [6].

Women who used cotton pants had a prevalence of 62.5%, while those who used nylon pants recorded 60% and statistically, there was no significant association (OR: 0.72; 95% CI: 0.19–2.15; $P>0.05$) (Table 3). This finding is in accordance with findings from another study [6]. This result could be due to the fact that nylon-made pants prevent adequate aeration of the vagina and generate internal heat in the vagina which favor the multiplication of anaerobic and microaerophilic microorganisms [6].

Women who regularly took anti-inflammatory drugs, recorded a prevalence of 70.0% for *Gardnerella vaginalis* infection, compared to 58.6% for those who did not take anti-inflammatory drugs. There was a significant association between regular intake of anti-inflammatory drugs with the occurrence of *G. vaginalis* infection (OR: 4.01; 95% CI: 1.2–13.01; $P<0.05$) (Table 3). This could be explained by the fact that prolonged and uncontrollable intake of anti-inflammatory drugs can cause temporary immune depression of the host and thereby increase susceptibility to infections.

5. Conclusions

Results from this research work indicated an overall prevalence of 62% for *Gardnerella vaginalis* infection. Socio-demographic data showed that women in the age range 16–25 years recorded a significant highest prevalence of the infection than in the other age groups. Participants who were single, recorded higher prevalence than married women. The findings of this study showed that women who were employed had a prevalence lower prevalence than women who were unemployed and self-employed. Clinically, those who presented with abnormal vaginal discharge had significantly highest prevalence of *Gardnerella vaginalis* infection than those who presented with burning sensation while urinating and vagina itches. Predisposing factors which predict occurrence of *Gardnerella vaginalis* infection (vaginosis) among women of child bearing age may show differences with the study group under investigation. This study revealed that lifestyle habits such as usage of antiseptic soap while douching, being sexually active, as well as diabetic conditions and regular intake of anti-inflammatory drugs strongly predicted occurrence of *Gardnerella vaginalis* infection.

Considering the above observations, it is important that women of reproductive age should carry out frequent screening for vaginal infections and determine factors to predict its occurrence, which will help policy makers to put in place appropriate preventive and treatment measures to curb

complications during pregnancy and transmission of STDs. Further research work is needed to enumerate *Lactobacilli* population and other microflora in the vagina in order to determine if there is a negative shift in the *Lactobacillus*-dominated environment with corresponding overgrowth of *Gardnerella vaginalis* so as to complement the diagnosis of bacterial vaginosis.

Abbreviations

GAV	Gardnerella Associated Vaginosis
UTIs	Urinary Tract Infections
PID	Pelvic Inflammatory Disease
STD	Sexually Transmitted Diseases
BV	Bacterial Vaginosis

Acknowledgments

The authors show gratitude to the South West Regional Delegate for Public Health, Dr Eko Flaubert who authorized the study to be conducted at the Buea Regional Hospital Annex, and for the assistance offered for this piece of work to be realized.

Author Contributions

Ekwi Damian Nsongmayi: Conceptualization, Writ-

ing-original draft, Resources, Supervision

Ngwa Fabrice Ambe: Data curation, Software, Writing-review and editing, Validation

Ebong Serge Bruno: Data curation, Methodology, Visualization, Review and editing

Lendem Isabelle: Investigation, Methodology, Resources, Software, Project administration

Edima-Durand Helene Carole: Investigation, Project administration, Validation

Ntemun Wartard Emmanuela: Data curation, Data analysis, Formal Analysis

Funding

This study was financed by the authors. There was no external source of funding.

Data Availability Statement

The data to support results recorded in this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no interest conflicts with regards to this study.

Appendix

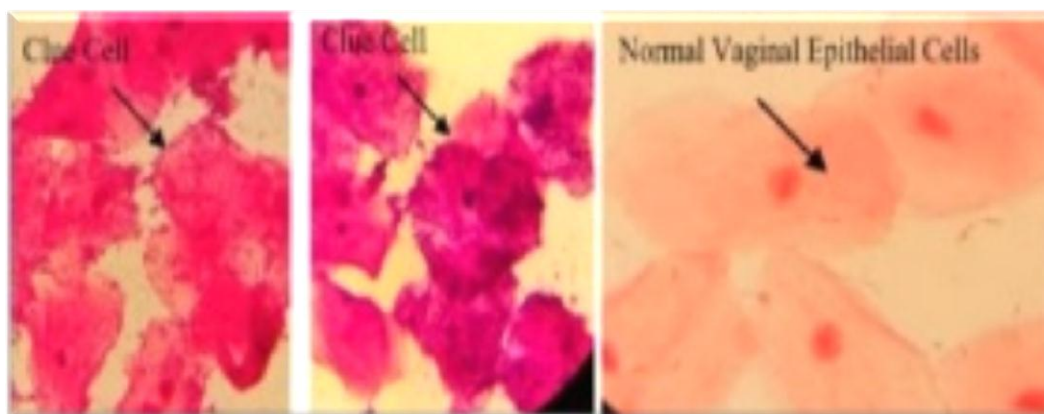


Figure 1. Microscope image of coccobacilli bacteria accumulating around vaginal epithelial cell.

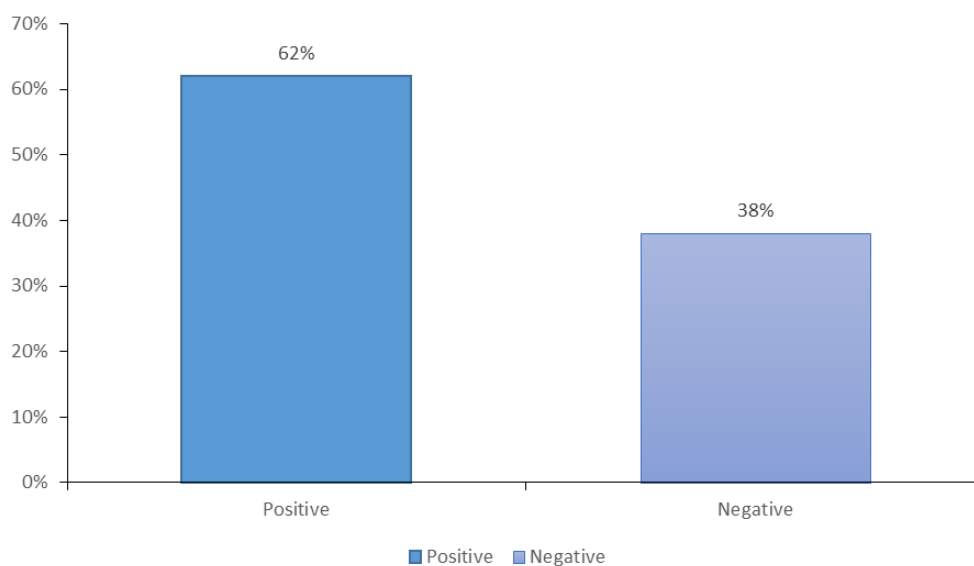


Figure 2. Overall Prevalence of *Gardnerella vaginalis* infection among study participants.

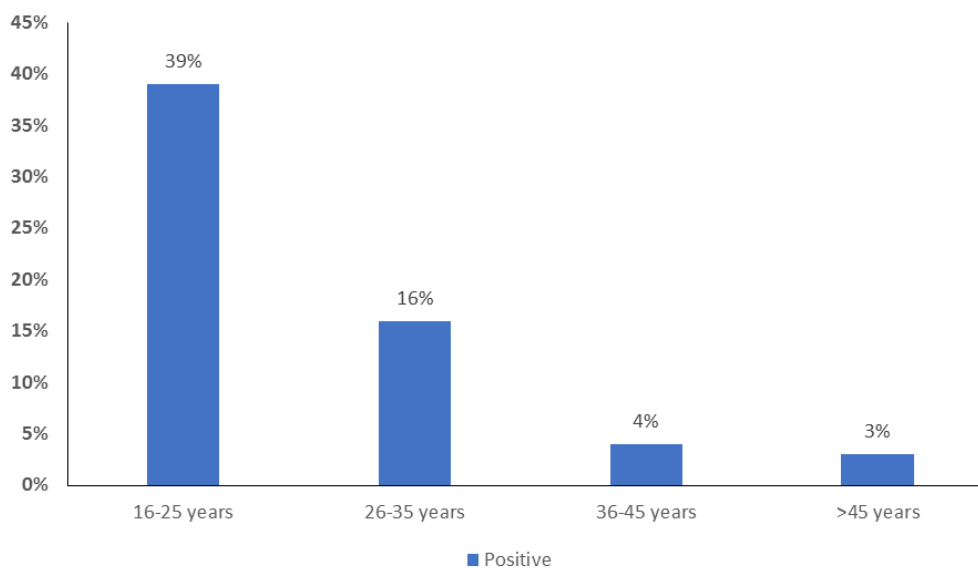


Figure 3. Prevalence of *Gardnerella vaginalis* infection by age group.

Table 1. Burden of *Gardnerella vaginalis* infection considering Socio-economic status among participants.

Parameter	Socio-economic Status	Frequency (N=200)	Positive (N=124)	Percentage (%)	P-Values
Marital status	Married	84	48	57.1	0.29
	Single	116	76	65.5	
Occupation	Employed	26	13	50	0.49
	Unemployed	72	47	65.3	
	Self employed	102	64	62.7	
Religion	Catholic	50	24	48	0.08
	Protestant	70	42	60	
	Muslim	10	2	20	

Parameter	Socio-economic Status	Frequency (N=200)	Positive (N=124)	Percentage (%)	P-Values
Level of education	Others	70	56	80	0.61
	No formal education	26	18	69.2	
	Primary	12	8	66.7	
	Secondary	50	32	64	
	Tertiary	112	66	58.9	

Data is presented as frequency and percentage. Positive represents women who had positive culture and were positive for Clue cells and Whiff test. Percentage is calculated considering the number of positive on the total number of participants for each parameter.

Table 2. Percentage positive for *Gardnerella vaginalis* infection in patients with and without Symptoms.

Clinical Parameters		Frequency (N=200)	Positive (N= 124)	Percentage (%)	P-Values
Experiencing vaginal itches	Yes	82	56	68.3	0.04
	No	118	68	57.6	
Abnormal vaginal discharge	Yes	96	72	75	0.02
	No	104	52	50	
Burning sensation when urinating	Yes	72	52	72.2	0.03
	No	128	72	56.3	

Data is presented as frequency and percentage. Positive represents women who had positive culture and were positive for Clue cells and Whiff test. Percentage is calculated considering the number of positive on the total number of participants for each parameter.

Table 3. Factors associated with occurrence of *Gardnerella vaginalis* infection among study participants.

Life style parameters		Frequency (N=200)	Positive N= 124	Percentage (%)	Odd Ratio (95%CI)	P-value
Use antiseptic soap while douching	Yes	40	32	80	4.92 (1.4–13.66)	0.026
	No	160	92	57.5		
Iron pants before wearing	Yes	38	22	57.9	2.6 (0.89–4.52)	0.081
	No	162	102	62.9		
Number of persons using single toilet	One	18	10	55.6	1.55 (0.68–4.11)	0.245
	Two	64	38	59.4		
	>Two	118	76	64.4		
Choice of panties	Cotton	160	100	62.5	0.72 (0.19–2.15)	0.383
	Nylon	40	24	60		
Diabetic	Yes	18	14	77.8	3.13 (1.99–9.43)	0.041
	No	182	110	60.4		
Regularly take anti-inflammatory drug	Yes	60	42	70	4.01 (1.2–13.01)	0.038
	No	140	82	58.6		
Sexually active	Yes	146	98	67.1	2.88 (1.1–10.06)	0.04
	No	54	26	48.1		

Life style parameters		Frequency (N=200)	Positive N= 124	Percentage (%)	Odd Ratio (95%CI)	P-value
Prior exposure to any sexually transmissible diseases (STDs)	Yes	122	78	63.9	1.44 (0.59–4.01)	0.07
	No	78	46	58.9		

OR = Odd Ratio; CI: Confidence Interval. Positive represents women who had positive culture and were positive for Clue cells and Whiff test. Percentage is calculated considering the number of positive for *Gardnerella vaginalis* infection on the total number of participants for each parameter

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TO: Ntemun Watard Emmanuela.
 Department Medical
 Laboratory Science,
 Fomic Polytechnic University Buea.

SUBJECT: ADMINISTRATIVE AUTHORIZATION

While acknowledging receipt of your correspondence in relation to your request for an authorization to carry out a research study titled 'Prevalence of Gardnerella Vaginalis and its Associated Risk Factors Among Women of Reproductive Age Attending Tertiary Hospital';

I have the honor to authorize this academic exercise after a careful review of the research proposal and considering its importance in generating information and data that could help to inform policy and decision-making regarding the prevalence of Gardnerella Vaginalis and its Associated Risk Factors Among Women of Reproductive Age Attending Tertiary Hospital.

I therefore call on the health facility concerned and the participants to give this student the necessary assistance needed to enable his carryout this study of scientific importance.

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Figure 4. Ethical Approval.

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Biography



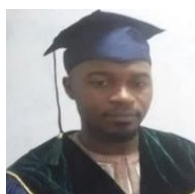
Ekwi Damian Nsongmayi is a lecturer at the University of Ebolowa, Cameroon, Department of Biomedical and Medical Sciences. He completed his Ph. D in Microbiology from the University of Buea (Cameroon) in 2022 and his professional Master's degree in Medical

Virology/Infectious diseases from the University of Yaoundé I in 2008. He participated at the APHA international conference and workshops on Public Health and infectious diseases and Expositions in San Diego, California, USA in 2008 and earned a certificate of recognition. He has expertise in Clinical trials, Clinical laboratory practice, Bioinformatics and Molecular Evolutionary Genetics Analysis. In recent years he has worked in a couple of research projects on infectious diseases nationally and internationally. He currently serves as a Pedagogic Coordinator of Biomedical Sciences in the department of Biomedical and Medical sciences of the University of Ebolowa and has been invited to be a keynote Speaker at the 10th International Conference on Biology and Life Sciences in November 2024 in Nanjing, China.



Ngwa Fabrice Ambe is a diligent public health/ infectious disease researcher with a BSc in Medical Laboratory Science, an MSc in Medical Microbiology and Parasitology, and a PhD in Microbiology. He possesses diverse certifications, including expertise in Global public health management, Good

Clinical Laboratory Practice, clinical trials, immunoassays, molecular techniques, bioinformatics, and Bioedits research. Fabrice has extensive research experience in probiotics, mucosal immunology, malaria, TB and HIV immunology, antimicrobial resistance, public health, gut microbiome, data collection, epidemiology of infectious and non-infectious diseases, drug discovery, and infectious disease immunology. Fabrice is a highly organized, collaborative team scientist with project management skills to keep projects on time and budget to completion and work well independently and as part of a team.



Ebong Serge Bruno is a lecturer at Ebolowa University, Biomedical and Medical Sciences Department. He completed his PhD in Biology and Human Physiology from Douala University in 2022, and his Master of Human Biology and Public health from the same institution in

2015. He has participated in multiple international research collaboration projects in recent years. He currently serves on the Editorial Boards of numerous publications and has been invited as a Keynote Speaker at international conference at St Etienne, France in October 2024.



in 2008 at the same faculty.

Lendem Isabelle is a lecturer at the University of Ebolowa, Department of Biomedical and Medical Sciences. She completed a specialist certificate in biology in 2015 at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I and a doctor of medicine degree



Edima-Durand Helene Carole is a professor of applied Biological Sciences and pioneer Dean of the Faculty of Science of the University of Ebolowa, Cameroon. She has done a number of research publications in diverse fields in biology, biotechnology and applied Sciences. She has affiliations to

both national and international Universities and participated in multiple international and national research collaboration projects in past and recent years. She has been invited to be a keynote speaker in a number of conferences. She currently serves as the Dean of the Faculty of Science, University of Ebolowa, Cameroon.



Ntemun Watard Emmanuela is a postgraduate student in the University of Buea, department of Medical Laboratory Sciences. She completed a higher national diploma and bachelor's degree in medical laboratory sciences in 2022 and 2023 from Fomic Polytechnic University Buea and

University of Buea, respectively. She has participated in a number of conferences and workshops on laboratory practice and quality assurance.

Research Field

Ekwi Damian Nsongmayi: Human microbiome in relation to disease causation, Probiotics and application in health and pharmaceuticals, developing novel antimicrobial peptides against drug resistance, laboratory medicine, Epidemiology of neglected tropical diseases, Zoonotic diseases, Identifying genetic markers in disease pathogenesis.

Ambe Fabrice Ngwa: HIV/AIDS, Viral hepatitis, epidemiology, antimicrobial resistance, public health, Probiotics and gut microbiome, Mucosal immunology, Malaria, neglected tropical disease, drug discovery, zoonotic infections

Ebong Derge Bruno: Medicine, biology, public health, parasitology, virology, molecular biology, reproductive health, nursing sciences.

Lendem Isabelle: Medicine, clinical biology, parasitology, bacteriology, clinical biochemistry, molecular biology, reproductive health, nursing sciences, hematology.

Edima-Durand Helene Carole: Food microbiology, Infection biology, biotechnology, global public health, applied biology, applied science, pharmacognosy, molecular techniques, collaborative team scientist with project management skills.

Ntemun Watard Emmanuela: Candida infections in women, Bacterial vaginosis in women, parasitology, clinical biology, histopathology and cancer of the cervix and breast, clinical chemistry, blood transfusion reactions