



Prevalence of bacterial vaginosis due to *Gardnerella* species, vaginal candidiasis and trichomoniasis: Epidemiological aspect in women and adolescent girls in Yaoundé, Cameroon.

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ABSTRACT

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Vaginal infections are a health problem due to their high frequency in our healthcare facilities. The objective of this work was to evaluate the prevalence of vaginal candidiasis, bacterial vaginosis due to the *Gardnerella* species and trichomoniasis, and study the associated risk factors among women and adolescents in the city of Yaoundé. *Trichomonas vaginalis* was identified by searching for a viable trophozoite by spreading leucorrhoea between slide and slide cover in physiological water. *Candida species* was found by culture on Sabouraud Chloramphenicol agar. Bacterial vaginosis was revealed according to the Thomasson classification. *Gardnerella species* was identified by Gram stain. The findings were: 52.37% of women had vaginal infections. Bacterial vaginosis had a prevalence of 32.92% and gardnerellosis represented 20.66% of vaginal infections, while candidiasis amounted to 16.66%. 0.79% of women suffered from trichomoniasis. The population most affected by bacterial vaginosis due to *Gardnerella species* was between 25 and 34 years old (13.49%). University level women and adolescents girls were more exposed to bacterial vaginosis due to *Gardnerella species* (15.87%) than high school level women and adolescents girls (3.18% and 2.38% respectively). Further studies on a larger sample of patients are required to further appreciate the epidemiology of vaginal infections.

KEYWORDS: Bacterial vaginosis, vaginal candidiasis, trichomoniasis, women, Yaoundé

INTRODUCTION

The female genital tract is colonized by a set of commensal microorganisms, consisting mainly of lactobacillus that maintain the acidic pH and thus prevent the proliferation of pathogenic germs such as bacteria, parasites and fungi.¹

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However, in spite of the control exerted by these bacteria, many microorganisms manage to establish themselves and finally cause genital infections.^{2,3} Women often suffer from vaginal candidiasis. It is a frequent reason for consultation in gynecology and is second only to bacterial vaginosis. It is estimated that 75% of women will experience at least one episode of *Candida* vaginitis in their lifetime.^{4,5} The pathogen usually responsible is *Candida albicans*, a commensal yeast of the vaginal mucosa.^{5,6} Vaginal candidiasis is thought to be favored by a disruption of the vaginal equilibrium and the mechanism of local immunity allowing colonization by candida species. It is closely related to the existence of certain factors such as hormonal changes during pregnancy, the use of oral contraceptives and local factors such as insufficient hygiene and certain general factors such as diabetes.^{7,8} This

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vaginal candidiasis is only a danger for the foetus and the newborn when the manifestations occur in a context of prematurity where the prognosis can be vital.^{9, 10} Another condition that often affects the female genital tract is bacterial vaginosis. This is an infection that reflects an imbalance of the vaginal flora with the replacement of lactobacilli (Doderlein flora) by anaerobic microorganisms whose proliferation is responsible for symptoms such as leucorrhoea. The main bacteria of bacterial vaginosis are: *Gardnerella vaginalis*, *Gardnerella piovii*, *Gardnerella swidsinskii*, *Gardnerella leopoldii*, *Mobilunucus*, *Atopobium*, *Bifidobacterium*, *Sneathia*.^{11, 12, 13} This pathology affects approximately one in three women of childbearing age each year in the world.¹⁴ A study conducted by Brown *et al* (2013) reported a prevalence of bacterial vaginosis of 21% in women in the United States of America.¹⁵ Other studies report prevalence of bacterial vaginosis of 15.2% in Ethiopia¹⁶ and 48.6% of women in India.¹⁷ In the assessment of women aged 14-49 years from the 2001-2004 National Health and Nutrition Examination Survey, the prevalence of bacterial vaginosis was 3.13 times higher in African American women than in Caucasian women [18]. Bacterial vaginosis is also positively associated with a risk of developing endometritis after childbirth or abortion.¹⁹ Finally, trichomoniasis is an infection that is also thought to affect women. It is a cosmopolitan parasitosis that is widespread throughout the world. It is estimated that between 150 and 200 million people worldwide are infected each year.²⁰ In women, the organism can be found in the vagina, cervix, bladder, Bartholin's, Skene's or periurethral glands.²¹ Symptomatic women usually experience a foul-smelling, green or yellow, foamy-looking vaginal discharge.²² In addition, considerable pruritus, dysuria and dyspareunia may occur. In Cameroon, vaginal infections are a frequent reason for consultation in health facilities. The main objective of this study was to evaluate the prevalence of three vaginal infections: Vaginal candidiasis, *Gardnerella species* bacterial vaginosis, and Trichomoniasis, and to evaluate the associated risk factors among women and adolescents girls in the city of Yaoundé.

MATERIAL AND METHODS

This descriptive and cross-sectional study was initiated by the Institute of Medical Research and Study of Medicinal Plants of Yaoundé (IMPM), more precisely at the Center for Research in Health and Priority Pathologies (CRSP). It was conducted during the month of March 2022 at the Human Biology Laboratory of the center during the open days organized for the International Women's Day. The study included any woman or adolescent girl aged between 16 and 45 years, who gave written informed consent and in whom a cervico-vaginal swab was performed. Postmenopausal women, menstruating women, women undergoing antibiotic or antifungal treatment, and women who had performed intimate hygiene within 24 hours were excluded from the

study. A survey form was designed to collect socio-demographic characteristics, information on the number of sexual partners in the last six months, intra-vaginal practices and the use of a product during vaginal douche (simple water, salt water, antiseptic product). 126 patients were enrolled. The sample size was calculated according to the Lorentz formula based on the prevalence of vaginal candidiasis of 11% reported in the study by Mogtomo *et al.* (2016).²³

Laboratory identification of microorganisms:

Trichomonas vaginalis was identified by direct examination (spread of leucorrhoea between slide and coverslip in physiological water 9 per thousand) and by looking for viable trophozoite using the light microscope under x10 and x40 objectives, then we also looked for yeasts and filaments in it. Then for yeast diagnosis, all samples were Gram stained and observed at objective 100× with immersion oil. All swabs were cultured on Sabouraud plus chloramphenicol to confirm the presence of yeast. A number of colonies greater than or equal to 10 of a vaginal sample culture is considered to be a pathogenic character of the isolated yeast

Finally, bacterial vaginosis was identified using two concomitantly positive methods: The sniff test was used to test for the production of a rotten fish odor on leucorrhea in the presence of 10% potassium and the Gram stain was used to type the vaginal flora. This was classified into four different types: Type I, for slides that contained only Gram-positive bacilli (Doderlein flora) indicating normal vaginal flora; Type II, for slides containing Gram-positive bacilli and few other bacteria; Type III, for slides containing few Gram-positive bacilli and many other bacteria indicating bacterial vaginosis and Type IV for slides without Gram-positive bacilli indicating bacterial vaginosis (Thomasson's classification).²⁴ Finally *Gardnerella species* which are Gram-negative or Gram-variable coccobacilli usually associated with clue cells have been identified in some flora of bacterial vaginosis by Gram stain.

Ethical considerations

Written, informed consent was obtained from each study participant. Participants were informed about the objectives of the study and the confidential and non-binding nature of participation in the study. Women were free to withdraw from the study without affecting the quality of care they received. Ethical clearance was obtained from the National Ethics Committee of Cameroon (N° 087/CNE/DNM/27).

Statistical analysis

Data were entered into Excel 2016 (Microsoft Office 2016) and then analyzed in Epi-info software version 3.5.4. Pearson's chi-square (χ^2) test and Fisher's exact probability were used to compare proportions. The threshold for statistical significance was set at a p-value <0.05.

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RESULTS

Characteristics of the study population

The age of the patients varied between 16 and 45 years with an average of 31±10 years. The study population was mainly composed of patients aged between 25 and 34 years with a total of 62 patients (49.20%). The study population consisted mainly of single women (75.39%). Women with a higher level of education were more represented with a prevalence

of (68.25%), followed by those with secondary education (26.19%). The majority of women came from the urban area (77.77%). Most of our patients had a sexual partner during the last six months before the study and represented 67.46%. Those who regularly practiced vaginal showering represented 68.25% of all women, and 38.88% of them used a product during vaginal showering (Table 1).

Table 1 : Characteristics of the study population

Characteristics	Number (126)	Percentage (%)
Age groups (years)		
< 25	36	28.57
25-34	62	49.20
≥ 35	28	22.22
Marital status		
Married	31	24.60
Single	95	75.39
Educational level		
Primary	07	5.55
Secondary	33	26.19
University	86	68.25
Place of residence		
Urban	98	77.77
Rural	28	22.22
Number of sexual partners during the last six months		
None	19	15.07
One	85	67.46
At least two	22	17.46
Vaginal douching practice		
Yes	86	68.25
No	40	31.7
Usage of product during vaginal douching		
Yes	49	38.88
No	77	61.11

Examination of specimens, cervix, characterization of flora type and evaluation of pruritus:

On gross examination, discharge was pathological in 37.30% of cases. Speculum examination performed during vaginal sampling had shown a cervix of normal appearance in 83.53% of cases and an inflammatory cervix in 17.46% of cases. The

study of the vaginal flora after Gram staining had shown a predominance of Type I+II flora with 65.07%. Type III+IV flora or bacterial vaginosis flora accounted for 34.92%. 47.61% of women complained of vaginal pruritus (Table 2)

Table 2: Distribution of participants according to the aspect of cervix, vaginal flora type, leucorrhoea and vaginal pruritus.

	N=126	Percentage (%)
Aspect of cervix		
Normal	104	82.53
Inflammatory	22	17.46
Leucorrhoea		

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Few	79	62.69
Abundant (pathologic)	47	37.30
Type of flora		
Type I+II	82	65.07
Type III+IV (bacterial vaginosis flora)	44	34.92
Vaginal pruritus		
Yes	60	47.61
No	66	52.38

Results showed an overall prevalence of 52.37% for all types of vaginal infections. Bacterial vaginosis was the most frequent infection (34.92%) and *Gardnerella species* was found in 20.63% (26/126) of bacterial vaginosis flora, the other germs of bacterial vaginosis flora could not be

identified due to lack of reagents. Vaginal candidiasis was found in 16.66% (21/126) of women and adolescents. Vaginal trichomoniasis was the least frequent vaginal infection, with only one woman out of 126 in the study testing positive (0.79%).

Table 3: Distribution of vaginal candidiasis and bacterial vaginosis with *Gardnerella species* according to socio-demographic characteristics, place of residence, number of sexual partners and vaginal pruritus

Characteristics	bacterial vaginosis with <i>Gardnerella species</i>		Vaginal candidiasis	
	Yes n(%)	P-Value	Yes n(%)	P-value
Age groups:				
< 25 years	03(2.38)	0.380	05(3.96)	0.960
25-34 years	17(13.49)		14 (11.11)	
≥ 35 years	06 (4.76)		02(1.58)	
Marital status :				
Single	23(18.25)	0,861	16(12.69)	0.167
Married	03(2.38)		05(3.96)	
Level of education				
Primary	02 (1.58)	0.720	03(2.38)	0.078
Secondary	04 (3.18)		03(2.38)	
University	20 (15.87)		15(11.90)	
Place of residence:				
Urban	24(19.04)	0.427	19(15.07)	0.398
Rural	02(1.59)		02(01.59)	
Number of sexual partners during the last six months				
None	07(5.55)	0.502	01(0.79)	0.284
One	14(11.12)		18(14.28)	
At least two	05(03.96)		02(01.59)	
Vaginal douching practice				
Yes	19(15.07)	0.160	03(2.38)	0.519
No	07(5.56)		18(14.28)	
Usage of product during vaginal douching:				
Yes	07 (5.56)	0.504	15(11.90)	0.032
No	12(9.51)		06(4.76)	
Vaginal pruritus				
Yes	19(15.07)	0.082	15(11.90)	0.222
No	07(5.56)		06(4.76)	

Table 3 represents the prevalence of vaginal infections in relation to selected risk factors. The population most affected by bacterial vaginosis with *Gardnerella species* was aged 25-34 years (13.49%), followed by those older than 35 years (4.76%). The same age group had more vaginal candidiasis (11.11%). Single women and adolescents were more infected with *Gardnerella species* bacterial vaginosis (18.25%) than those married (2.38%). Similarly, married women and adolescents had a low prevalence (3.96%) of vaginal candidiasis compared to those who were single (12.69%).

University level women and adolescents were more exposed to *Gardnerella species* bacterial vaginosis (15.87%) and vaginal candidiasis (11.90%) than high school (3.18% and 2.38% respectively) and primary level women and adolescents (1.58% and 2.38% respectively) and the difference was not significant. Regarding personal hygiene, women who practiced vaginal shower were more exposed to bacterial vaginosis with *Gardnerella species* (15.07%) and suffered less from vaginal candidiasis (2.38%). Regarding other factors, the prevalence of *Gardnerella species* bacterial

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vaginosis and vaginal candidiasis was higher in women and adolescents who had vaginal pruritus (15.07% and 11.90% respectively). Women with only one sexual partner in the past six months had more bacterial vaginosis (11.12%) and vaginal candidiasis (14.28%) than women who had no sexual partner (5.55% and 0.79% respectively). Urban women were more likely to have bacterial vaginosis with *Gardnerella species* (19.04%) and vaginal candidiasis (15.07%) than women living in rural areas (1.59% for both infections).

DISCUSSION

Vaginal infections are a health problem because of their high frequency in our health facilities.

Prevalence of genital infections

The prevalence of vaginal infections was 52.37%. This finding is lower than those found by Ngaba et al. (2014), and Nsagha et al. (2015) in studies conducted in Douala, Yaoundé and Dschang. These authors found a prevalence of 70.5% and 68.7% respectively.^{25,26} This prevalence is higher than the 15.4% reported in Ethiopian women of childbearing age by Mulu et al. (2015).¹⁶ These differences may be related to differences in study populations and the diagnostic performance of the tests used.

The women in this study had more bacterial vaginosis caused by *Gardnerella species* than vaginal candidiasis with a prevalence of 20.63% out of an overall prevalence of 34.92% of bacterial vaginosis flora (Type III and IV). Numerous studies by Nicand *et al* (2004) and Sedallan *et al* (2005) have shown that bacterial vaginosis with *Gardnerella species* is more frequently reported in vaginal infections.^{27,28} These results confirm the importance of gardnerellosis in the etiology of vaginal infections in developing countries.²⁹ Studies conducted by Bohbot et al. (2012) and Kamga et al. (2017) in pregnant women reported prevalence of bacterial vaginosis of 30% and 26.02% respectively.^{30,31} The prevalence of bacterial vaginosis from these two authors are relatively higher than the finding of this study. This difference can be justified by a larger sample size and moreover pregnant women have a decrease in their immunity, which exposes them to infections. On the other hand, Sanou et al. (2009) in Ouagadougou found a prevalence of 18.8% of bacterial vaginosis with *Gardnerella species*.³² The differences in prevalence reported in different locations could be due to the environmental and behavioral status and immunological profile of the patients and the screening techniques used were different.

Concerning trichomoniasis, only one patient out of 126 suffered from it in this study. A study by Dompta et al. (2019) reported a prevalence of trichomoniasis of 5.35% in samples of 516 patients.³³ Their higher prevalence compared to this study may be justified by their larger sample size.

Vaginal candidiasis is one of the most frequent infections in gynecological consultations. The prevalence of genital

candidiasis in the study was 16.66%; this result is higher than that reported by Mogtomo et al. (2016) in his study in Douala (11%).²³ This prevalence is lower than that found in Cameroon by Nsagha et al. 2015 who reported prevalence of 26.5%.²⁶ These differences in prevalence of vaginal candidiasis in different studies may be justified by the different socio-demographic characteristics of the study populations and the immunological status of the patients. A study conducted in pregnant women by Bamba et al. (2007) in Bamako found a prevalence of 48.7%³⁴ which is higher than the finding of this study. Their high prevalence can be justified by a high rate of progesterone and estrogen secretion during pregnancy, which decreases the vaginal defense mechanisms and increases the glycogen content in the vaginal tissue, a source of carbon for the yeasts, which favors their growth and multiplication. Moreover, pregnant women have a decreased immunity, which exposes them to vaginal candidiasis.^{35, 36, 37}

Genital infections and socio-demographic factors

The age group between 25 and 34 years was more infected with vaginal candidiasis (11.11%). Anane et al. (2015) and Benchellal et al. (2011) report in their study that the population of women aged 20-39 years and 25-35 years were more exposed to vaginal candidiasis.^{38, 39} Regarding *Gardnerella species* bacterial vaginosis, 25-34 year olds were also more exposed in this study (13.49%). Faye-Kette et al (1992) in Abidjan and Tambura et al. (2004) in Burkina Faso found that the 18-36 age group had more bacterial vaginosis: 63.84% and 64.3% respectively.^{39, 29} This is an age group where women are more exposed to vaginal infections.⁴⁰ The high exposure of this age group to these two infections in this study can be justified by the fact that women in this age group are of childbearing age and consult regularly in the gynecology department and are therefore more screened and finally at this age women are at their maximum sexual activity, which attacks the Doderlein flora that protects the vaginal cavity. Frequent sexual intercourse prevents the restoration of the vaginal ecosystem and, therefore, maintains an ideal environment for the growth of anaerobic bacteria.⁴¹ Single participants had more *Gardnerella species* bacterial vaginosis (18.25%) and vaginal candidiasis (12.69%) than those who were married. This could be justified by their multiplicity of partners and a high frequency of sexual intercourse which would destroy the protective flora of Doderlein, moreover single women were more represented in this study (75.2%).

Women with a university degree were more exposed to bacterial vaginosis with *Gardnerella species* (15.87%) and vaginal candidiasis (11.90%) in this study. The level of education had no significant influence in the contraction of vaginal infections in this study (; P=0.720; P=. 0.078 respectively). Yet Toua et al. (2019) and Achondou et al. (2016) reported in their study that women with primary

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education level had the highest prevalence of vaginal candidiasis, (that is, 50%) and bacterial vaginosis (60.5%).^{42, 43} The study by Bradshaw *et al.*, (2015) found that those under 13 years of age in school were at higher risk for bacterial vaginosis in general.¹⁸ These high prevalence of vaginal candidiasis and bacterial vaginosis among college women in this study may be justified by the poor information received about genital hygiene through social networks. 15.07% of women with bacterial vaginosis in this study practiced douching which destroys the protective flora of Doderlein and makes the pH of the vagina less acidic and predisposes to vaginal infections. In their study Achoudon *et al.* (2016) and Low *et al.* (2011) noted a high prevalence of bacterial vaginosis among women who practiced douching.^{43, 44}

Women and adolescent girls who had no sexual partner in the past six months were less exposed to *Gardnerella species* bacterial vaginosis (5.55%) and vaginal candidiasis (0.79%) than women who had a sexual partner (11.12% and 14.28% respectively). This could confirm that frequent sexual intercourse destroys the protective flora of Doderlein and exposes to genital infections.

The majority of the patients lived in urban areas and suffered more from vaginal candidiasis (15.07%) and bacterial vaginosis with *Gardnerella species* (19.04%). This can be justified by the fact in the city they would have biased information on the maintenance of their vaginal cavity via social networks and would have easy access for their vaginal shower, to commercial products that destroy the flora of Doderlein. In addition, health centers are closer to their homes than to women living in rural areas, so they are more likely to be screened.

Clinic of genital infections

In this study 47.61% of women had vaginal pruritus as a symptom and among them 15.07 suffered from bacterial vaginosis with *Gardnerella species*, and 11.90% of them had vaginal candidiasis. A study conducted by Mtibaa *et al.* (2017) on 2160 vaginal samples to search for vulvovaginal candidiasis, 72.25% of women had vulvovaginal pruritus as a symptom⁴⁵ and Keita *et al.* (2008) in a study on bacterial vaginosis reported that 51% of women complained of vulvovaginal pruritus.⁴⁶ This difference in the occurrence of pruritus can be justified by the fact that their sample of women was very large compared to that of this study (126 women) and in the study conducted by Keita *et al.* (2008) the women also suffered from Human Immunodeficiency Virus (HIV) and therefore had a decreased immunity which would exacerbate the pruriginous symptomatology of bacterial vaginosis.

According to Omarova *et al.* (2022), the introduction of infectious agents into the genital tract is associated with the development of cervicitis.⁴⁷ However, in this study 82.53% of women had a normal cervix, which would suggest that vaginal candidiasis and bacterial vaginosis cause less cervical

inflammation in women and adolescents, which is confirmed by the study of Tamboura *et al.* (2004) who found that only 3.6% of women with bacterial vaginosis had cervical inflammation.²⁹

CONCLUSION

This study highlighted a high prevalence of *Gardnerella species* bacterial vaginosis among women in the city of Yaoundé. Single women and women with higher levels of education were at higher risk of *Gardnerella species* bacterial vaginosis and vaginal candidiasis. Further studies on a larger sample of patients are needed to further assess the epidemiology of these vaginal infections. Health education interventions would be recommended to raise awareness of genital infections and their prevention.

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