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Vulvovaginitis and Associated Factors in Pregnant Women Requesting a Cytobacteriological Examination of Cervical-Vaginal Sampling at the "Si Melon Laboratory" in the City of Yaoundé - Cameroon

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ABSTRACT

Vulvovaginitis, a significant public health issue, poses risks during pregnancy. This study identifies the germs causing vulvovaginitis and their associated factors in pregnant women at the Si Melon Laboratory in Yaoundé, Cameroon. In a 04-week study, vaginal secretions from 55 pregnant women were analyzed using Amsel's criteria, Nugent's scoring, and culture techniques. Antimicrobial sensitivity was assessed via disc diffusion, with statistical significance set at a p-value ≤ 0.05. Of the 55 women included in this study, 72.7% were carriers of germs involved in vulvovaginitis, and 52.7% were infected with at least two. *Gardnerella vaginalis* (44.5%), *Candida albicans* (24.7%), and *Mobiluncus spp* (16%) were predominant. Coinfections were common, particularly *Gardnerella vaginalis/Mobiluncus spp* (20.8%) and *Gardnerella vaginalis/Candida spp* (13.8%). Staphylococcus strains were sensitive to Ceftriaxone, Imipenem, and Amoxiclav, while Candida strains responded well to Econazole, Miconazole, Fluconazole, and Nystatin. Poorly maintained underwear and inadequate intimate hygiene were significant factors associated with infection. The study highlights the prevalence of various germs in vulvovaginitis among pregnant women, linked to suboptimal hygiene practices. Emphasizing proper hygiene could prevent potential complications and promote maternal well-being.

Keywords

Vulvovaginitis, profile, germs, associated factors, pregnant women, Yaoundé

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Introduction

Vaginal infections, which involve inflammation of the vulva and vagina, are a common health problem among pregnant women worldwide (Drew *et al.,* 2020). The rate of vaginal infections varies between countries and population groups. According to a recent analysis by the World Health Organization "WHO" (WHO, 2023) the global prevalence among women of reproductive age is between 23% and 29%. These infections can have serious consequences for pregnant women, such as miscarriage, premature rupture of membranes, or preterm birth. They are the second-leading cause of maternal deaths worldwide. Therefore, prompt diagnosis and treatment are important to protect the health of both mother and baby (Bonala *et al.,* 2014).

The prevalence of vulvovaginitis varies from country to country around the world, being higher in Africa and lower in America, Europe, and Asia. In sub-Saharan Africa, the rate among pregnant women is between 30 and 50% (Prudhomme *et al.,* 2007; Tchelougou, 2012). Common infectious agents identified include *Gardnerella vaginalis* and *Atopobium vaginae*, as well as fungal species such as *Candida albicans* (Chawanpaiboon and Pimol, 2010; Torondel *et al.,* 2018). Additionally, many studies report the presence of many others strains responsible for these infections.

For example, in 2010, in Thailand, specifically Bangkok, a study was conducted on the involvement of bacterial vaginosis in early labor and preterm babies. In this study, 36.4% of threatened abortions and 30% of preterm births were attributed to vaginal infections (Chawanpaiboon and Pimol, 2010). Similarly, in 2022 in India, an analysis proved that bacterial vaginosis is strongly associated with preterm births, thus showing the importance of including cytopathological examination of cervical-vaginal secretions in the prenatal assessment of every pregnant woman (Trishna *et al.,* 2022).

Furthermore, in Benin, specifically in Lhomel, a retrospective study from 2008 to 2011 was conducted to assess the profile of germs isolated from vaginal secretion samples in pregnant women at the Mother and Child Hospital of Laguine. At the end of this study, the most common isolated germs were *Candida albicans* with 76.27%, *Streptococcus agalactiae* with 12.71%, and *Streptococcus pyogenes* with 7.63% (Avanon *et al.,* 2012). In Algeria in 2018, the following germs were isolated from vaginal secretions in women: *streptococci, Candida albicans, Escherichia coli, Trichomonas vaginalis*, and *Staphylococci*; pregnant women were the most affected (Lefras and Landi, 2018).

In Cameroon, there have been few studies focusing on this subject. However, a study was conducted in 2014 in Douala, at the Bonassama District Hospital, on the profile of germs involved in cervico-vaginal infections in women of childbearing age. Among the target population of this study, 17.65% were pregnant women, and of these women, the most commonly isolated germs were *Candida albicans* at 33.33% and *Gardnerella vaginalis* at 5.56% (Ngaba *et al.,* 2014). During the same year, a prospective and cross-sectional study was also conducted at the Mycology Laboratory of the Faculty of Medicine and Biomedical Sciences of Yaoundé I on pregnant women. The study revealed 35.52% of cases of *Vulvovaginal candidiasis* with a predominance of *Candida albicans* (86.52%) and *Candida glabrata* (8.51%), and all participants in this study had at least one associated factor (Kechia *et al.,* 2015).

Similarly, a study conducted in 2015 on the bacteriological profile of vaginal infections in pregnant women diagnosed by cervical-vaginal swab at Afrique Labo in Douala revealed the predominance of *Gardnerella vaginalis* vulvovaginitis (Sigha *et al.,* 2016). The results obtained further underscored the importance of vaginal infections in our communities. However, more up-to-date epidemiological information in Cameroon and specifically in Yaoundé remains insufficient. It is against this backdrop that this work was developed with the objective of establishing the profile of germs involved in vulvovaginitis and their associated factors in pregnant women requesting a cytobacteriological examination of cervical-vaginal sampling (CECVS) at the "Si Melon Laboratory (SML)" in the city of Yaoundé. This could provide necessary information to strengthen and adapt context strategies to raise awareness and prevent the increase vulvovaginitis within our society.

Materials and Methods

Study Design, Location and Period

A prospective cross-sectional analytical study was conducted among pregnant women requesting a CECVS at the SML in the city of Yaoundé (Centre region of Cameroon) over a 4-week period from May 03 to 31, 2023. Cultures, strain identification, and additional biological analyses were performed at the SML.

Selection Criteria

Our study included all pregnant women who were recommended cervical-vaginal self-sampling by their doctor and who met the following conditions:

• No personal hygiene in the morning of sampling;
• No sexual relations the day before;
• No antibiotic therapy for at least the previous three days;
• Ability to freely engage in the study.

All pregnant women who did not match the aforementioned criteria were excluded from the study.

Data Collection Method

The data collection tool was a questionnaire sent to each pregnant woman included in our study. A file was created for each patient containing the following information: age, sex, marital status, religion, education level, weekly frequency of sexual intercourse, socioprofessional status, hygiene measures, and clinical parameters. A patient code was generated for greater confidentiality and recorded in each file.

Biological analyzes

Patient sampling

The sample was drawn from the 55 pregnant women enrolled in this study. The swabs were labeled with the patient's details required for the analysis. When the cervix was exposed, the exocervix was removed, followed by the vaginal wall using a sterile swab (Bohbot and Lepargneur, 2011). We started with inoculating in the appropriate culture media, a thin distribution on the object slide, then the swab was placed in the swab holder and a few drops of physiological water were added.

Macroscopic and microscopic examinations

The macroscopic examination of cervical-vaginal secretions was performed and consisted of noting the abundance, color, and appearance of the secretions. It also allowed appreciation of the odor and pH of the secretions.

The microscopic examination consisted of fresh and stained examinations; the fresh examination allowed us to search for the presence of yeasts (such as *Candida albicans*), parasites (such as *Trichomonas vaginalis*), and assess the presence of cellular elements such as leukocytes and red blood cells. To do this, each sample was impregnated with sterile physiological water, and the preparation thus obtained was observed under a microscope at 40X objective after focusing at 10X objective. The examination after Gram staining was always performed on the same sample. The smear (the thin distribution made previously on the object slide) was then dried, fixed, and Gram stained. The slide was then observed under a microscope at 100X objective with oil immersion. The Spiegel score was calculated from this spread.

Culture Techniques

The culture media were prepared following the manufacturer's instructions and were then inoculated. Isolation of germs (bacteria, yeasts, parasites, etc.) was performed on conventional media. These include Sabouraud's Agar, Blood Agar, Chocolate Agar, Eosin Methylene Blue Agar, Mannitol Salt Agar. All these culture media were obtained from Sigma-Aldrich (St. Quentin Fallavier). Incubation was carried out depending on the requirements of the different species of germs, usually at 37°C for 24 hours.

Identification of microorganisms

This step consisted of redoing the Gram staining from young colonies on culture media in order to confirm the initial results obtained. The identification of bacterial strains was based on the study of their morphological, cultural and biochemical characteristics. Catalase, oxidase and free coagulase were investigated for the identification of Gram-positive cocci. For catalase testing, hydrogen peroxide was used and bubbling observed to indicate the presence of catalase. A rapid color change of the reagent from colorless to violet indicated the presence of cytochrome oxidase. Free coagulase was observed by clotting of plasma. For yeasts, the filamentation or blastospore formation test was performed for the identification of *Candida albicans* and other species likely to infect pregnant women.

Antimicrobial Susceptibility Testing

The antibiotic susceptibility testing was performed according to the recommendations of the French Society for Microbiology Antibiogram Committee (FS-MAC). The method used was the Kirby-Bauer disk diffusion method. It consisted of the diffusion of antibiotic disks onto Muller-Hinton agar seeded by swab streaking of the 0.5 McFarland bacterial suspension. The bacterial suspension was prepared by picking 3–5 colonies of the pure bacterial culture and inoculating them into 5 mL of physiological water. The obtained solution was incubated for a few minutes at 37°C.

Seeding of the plate was done by streaking the bacterial suspension across the surface of Muller-Hinton agar (for antibiotic susceptibility testing) and Sabouraud agar (for antifungal susceptibility testing) using a sterile swab. Subsequently, the antibiotic (antifungal) disks were applied flat without sliding, pressing them lightly onto the surface of the Muller-Hinton (Sabouraud) agar using sterile forceps. A minimum distance of 15mm had to separate a peripheral disk from the edge of the plate, and two disks had to be separated by at least 30mm so that inhibition zones did not overlap. Incubation was done at 37°C in an incubator for 24 hours. For reading and interpretation of results, the diameters of inhibition zones around the disks were measured (see Figures 1a and b). By comparison to the diameters listed on the corresponding reading chart, the resistance profile of the different tested strains was determined.

Statistical Analysis

The collected data were checked for completeness and consistency, then entered into the CSPro (Census and Survey Processing System) version 7.0 software and transferred to SPSS (Statistical Package for Social Sciences) version 25.0 for statistical analysis. Descriptive statistics were used to show the distributions of each study variable to determine their characteristics (frequencies). Prevalence represents the proportions of a group relative to the total group or population size expressed as a frequency. Binary logistic regression analyses allowed the simultaneous study of associations between behavioral and sociodemographic factors and the positivity rate. The strength of associations was analyzed using the odds ratio (OR) with a 95% confidence interval (95% CI). Results were considered statistically significant at $p \leq 0.05$.

Ethical considerations

Respect for those surveyed was maintained throughout the study, as was the anonymity of the data. This study was conducted in accordance with the Declaration of Helsinki. Prior to giving the questionnaire, all respondents were informed of the study's aim and objectives via an oral message. Before beginning data collection, we got consent from the director of the Si Melon Laboratory to undertake an investigation (Authorization N° 01/DACD/D/RLS/10/03-23). The anonymity of the people being surveyed is assured. In addition, each person expressed their agreement before answering the questions. Participation in the study was therefore entirely voluntary.

Results and Discussion

Sociodemographic and clinical characteristics of study participants

A total of fifty-five (55) women were included in this study. The majority of participants (54.5%) belonged to the age group of 18 to 29 years, closely followed by the 30 to 39-year-old age group (34.5%). Only 11.11% of participants were 40 years of age or older. Regarding occupation, participants were mainly pupils or students (25.5%) and had small jobs (25.5%). Traders accounted for 12.7% of the sample, while housewives and teachers/civil servants each represented 23.6% and 12.7%, respectively. Among participants, 38.2% reported having no income, while 23.6% had an income less than or equal to 50,000 CFA francs and 38.2% had an income over 50,000 CFA francs. In relation to pregnancy stage, the majority of pregnancies were in the first trimester (63.6%), followed by the second trimester (32.7%), and a small percentage (3.7%) were in the third trimester.

The results also revealed that the most frequent complaints were dyspareunia (38.2%) and vaginal discharge/leukorrhea (20%). Pruritus was present in 14.5% of participants, while urinary burning and abdominal cramps were less frequent.

Among past medical histories, premature delivery (27.3%) and previous vulvovaginal infections (43.6%) were most common. Miscarriages were less frequent (5.5%), while the use of antiseptic products was mentioned by 23.6% of participants. Regarding vaginal flora status, it was found that the majority of participants had an unbalanced flora (63.6%), while 27.3% had a normal flora and 9.1% had an intermediate flora. The positivity rate at clinical diagnosis shows that the clinical diagnosis was positive in 72.7% of cases, while 27.3% of cases were negative.

Pregnant women's hygiene practices

Table 2 reveals that the majority of pregnant women (76.4%) reported using poorly maintained underwear, while 23.6% reported not doing so. This highlights a potential issue of hygiene and personal care among these women. Regarding improper intimate cleansing, a large proportion of pregnant women (61.8%) indicated that they do not properly cleanse their intimate area, while 38.2% reported doing so correctly. In relation to the use of synthetic underwear, the results show that over half of pregnant women (56.4%) reported using synthetic underwear, while 43.6% reported not doing so. Furthermore, only 23.6% of pregnant women reported using antiseptic products, while the majority (76.4%) did not use any.

Frequency of isolated and mixed strains

From Figure 2, it can be seen that 52.7% of participants were infected by at least two germs, while 44.5% of participants were infected by *Gardnerella vaginalis*.

Regarding the frequency of pairs of germs in cases of mixed infections in the study population, it turns out that 41.4% of participants were infected by the pair of germs *G. vaginalis/Candida spp*, followed by the pair of germs *G. vaginalis/Mobilancusspp* (20.8%) (Figure 3).

Germ sensitivity to antibiotics

The Staphylococcus germs were more sensitive to the antibiotics CTR (100%), IPM (87.5%) and AMC (87.5%), and resistant to the antibiotic CAZ (75%) (Table 3).

Regarding the *Candida albicans* germ, the tests showed high sensitivity to the antifungals ECO (95.5%) and MCZ (78.2%), Fluconazole (74%) and Nystatin (74%), and resistance to KTC (39.1%) (Table 4).

Factors associated with positive rates

The analysis of Table 5 shows that the risk factors associated with positivity rates were the use of poorly maintained underwear (OR = 13.50; 95% CI: 3.13-58.18; p-value = 0.0001) and improper intimate cleansing (OR = 5.88; 95% CI: 1.17-29.50; p-value = 0.031). Vaginal infections are common medical problems among women and are associated with significant discomfort, significant morbidity, and therefore frequent medical visits (Judlin and Thiébaugorges, 2005). The main objective of this study was to establish the profile of germs involved in vulvovaginitis and associated factors in pregnant women. Thus, 55 pregnant women were registered, with ages ranging from 18 to 44 years, with the 18–29 age group being the most represented with proportions of 54.5%. This result is similar to that obtained by Tchelougou (2012) in Togo (62.63%), and in Benin by Soho (2020) (65.79%). The large representativeness of this age group is not only due to frequent sexual activity within this age group but also because majority of women express the desire child bearing at this time (Soho, 2020). Among this sample, 72.7% tested positive for infections. This positivity rate is slightly lower than that obtained by Sadik (2018) in Marrakech (79.66%) and much higher than that obtained in Benin the same year by Soho (2020) (47.37%). This thus highlights the importance of raising awareness and preventing genital infections in pregnant women, as this represents a real public health problem, according to the World Health Organization.

From the positive samples, we isolated 81 microbial strains. Strains of *G. vaginalis* were the most represented (44.5%), followed by *C. albicans* (24.7%), *Mobiluncus spp* (16%), and *Staphylococcus aureus* (7.4%). *Candida spp, Staphylococcus spp* (SCN), and *T. vaginalis* were the least represented, with 3.4%, 2.5%, and 1.2%, respectively. These results are similar to those obtained by Tchelougou (2012), but with different proportions: *G. vaginalis* (55.31%), *Candida spp* (30.77%), *S. aureus* (5.59%), *T. vaginalis* (3.66%), and *Mobiluncus spp* (0.37%) (Tchelougou, 2012).

The low representativeness of *Trichomonas vaginalis* (1.2%), similar to that obtained by Karou *et al.,* (2010) (1.04%), indicates the rarity of these germs in women during gestation. This classification once again shows us that *G. vaginalis* and *C. albicans* will be the two main causes of vulvovaginal infections in pregnant women.

Indeed, 52.7% of the study population had a mixed infection. This rate is higher than those obtained by Tchelougou (2012) and Sadik (2018) who found 23.08% and 11% respectively, despite the larger sample sizes in their studies.

Table.1 Distribution of the study population according to sociodemographic and clinical characteristics

Variables	Frequency	%
Ages		
18-29	30	54.5
30-39	19	34.5
≥ 40	6	11.11
Occupation		
Student	14	25.5
Trader	7	12.7
Small jobs	14	25.5
Housewife	13	23.6
Teacher/Civil servant	7	12.7
Income level (CFA francs)		
No income	21	38.2
Income ≤ 50,000	13	23.6
Income > 50,000	21	38.2
Gestational age		
First trimester	35	63.6
Second trimester	18	32.7
Third trimester	2	3.7
Complaints/clinical signs		
Vaginal discharge/leukorrhea	11	20
Pruritus	8	14.5
Dyspareunia	21	38.2
Urinary burning	14	25.5
Abdominal cramps	1	1.8
Past medical history		
Premature delivery	15	27.3
Previous vulvovaginal infection	24	43.6
Miscarriage	3	5.5
Antiseptic products	13	23.6
Vaginal flora status		
Normal	15	27.3
Intermediate	5	9.1
Unbalanced	35	63.6
Positivity rate at clinical diagnosis		
Positive	40	72.7
Negative	15	27.3

Table.2 Pregnant women's hygiene practices

Variables	Frequency	%
Using poorly maintained underwear		
Yes	42	76.4
No	13	23.6
Improper intimate cleansing		
Yes	34	61.8
No	21	38.2
Use of synthetic underwear		
Yes	31	56.4
No	24	43.6
Use of antiseptic products		
Yes	13	23.6
No	42	76.4

Table.3 Distribution of germ (Staphylococcus) sensitivity according to antibiotics

	IMP N (%)	AK N (%)	CTR N (%)	CAZ N (%)	GEN N (%)	AMC N (%)	A/S N (%)	LEV N (%)
Sensitive	7 (87,5)	2 (25)	8 (100)	0 (0)	6 (75)	7 (87,5)	4 (50)	3 (35,5)
Intermediate	1 (12,5)	3 (35,5)	0 (0)	2 (25)	2 (25)	1(12,5)	3 (35,5)	2 (25)
Resistant	0 (0)	3 (35,5)	0 (0)	6 (75)	0 (0)	0 (0)	1(12.5)	3 (35,5)

IMP: Imipenem; AK: Amikamycin; CTR: Ceftriaxone; CAZ: Ceftazidime; GEN: Gentamicin; AMC: Amoxicillin + Clavulanic acid; A/S: Ampicillin/Sulbactam; LEV: Levofloxacin.

Table.4 Distribution of germ (Candida) sensitivity according to antifungals

	FLU N (%)	AMB N (%)	ECO N (%)	KTC N (%)	NYS N (%)	MCZ N (%)
Sensitive	17 (74)	13 (56,6)	22 (95,7)	9 (39,1)	17 (74)	18 (78,2)
Intermediate	2 (8,7)	4 (17,3)	1 (4,3)	5 (21,8)	3 (13)	5 (21,8)
Resistant	4 (17,3)	6 (26,1)	0 (0)	9 (39,1)	3 (13)	0 (0)

FLU: Fluconazole; AMB: Amphotericin B; ECO: Econazole; KTC: Ketoconazole; NYS: Nystatine; MCZ: Miconazole.

Figure.1 Antibiotic sensitivity test

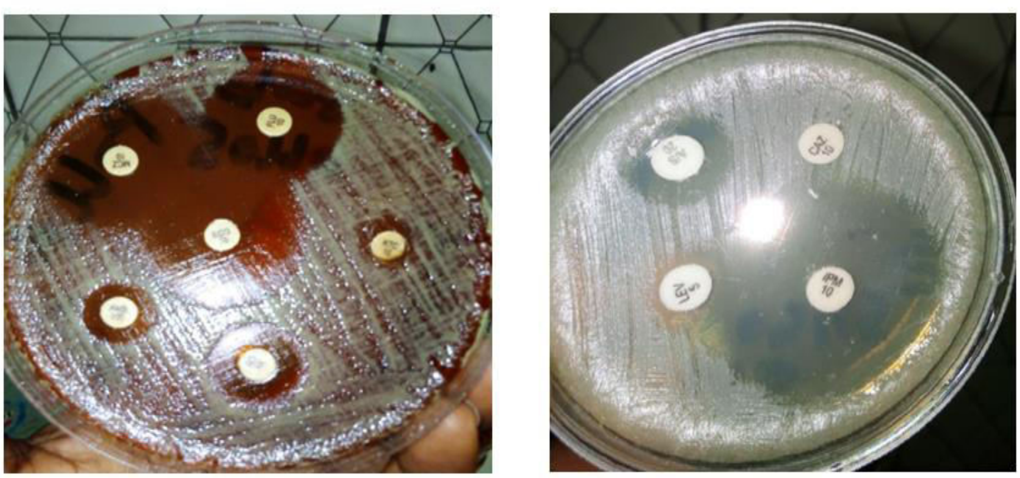
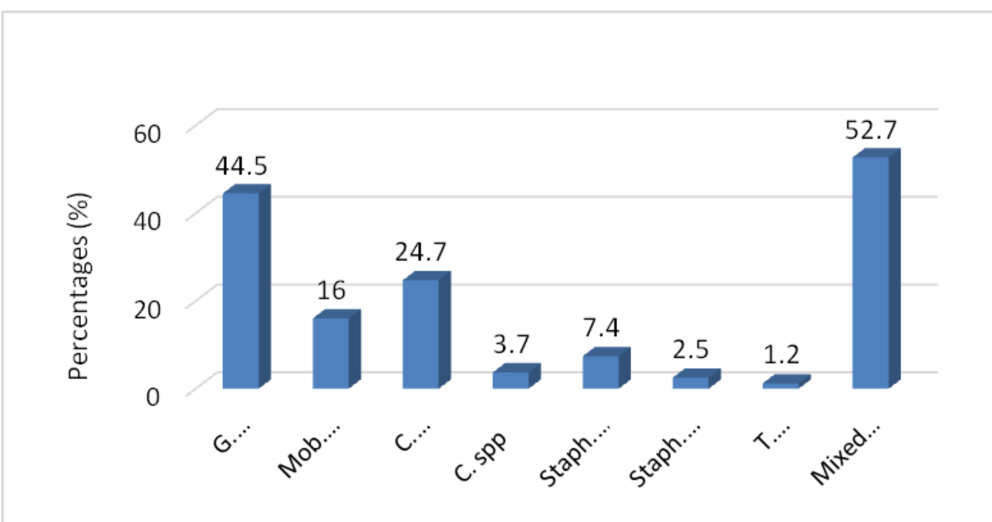


Table.5 Analysis of logistic regression of factors associated with positivity rates in pregnant women

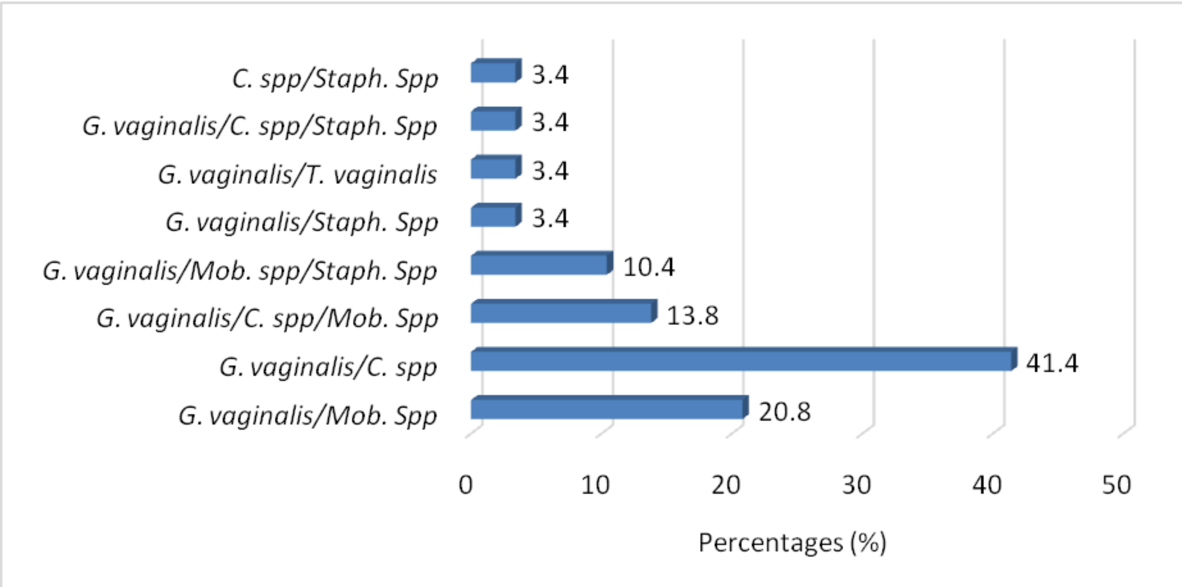
Factors	OR (IC à 95%)	P-value
Age (years)		
20-29	1	
30-39	0.42 (0.07-2.54)	0.429
≥40	2.28 (0.53-9.83)	0.267
Occupation		
High school/Student	1	
Trade	0.12 (0.01-1.03)	0.054
Small job	0.22 (0.03-1.39)	0.108
Housewife	0.91 (0.11-7.66)	0.936
Teacher/civil servant	1.00 (0.07-13.36)	1.000
Income level		
None	1	
≤50000	1.12 (0.25-4.97)	0.877
>50000	2.12 (0.51-8.77)	0.297
Synthetic underwear		
No	1	
Yes	0.58 (0.17-1.92)	0.377
Poorly maintained underwear		
No	1	
Yes	**13.50 (3.13-58.18)**	**0.0001**
Improper intimate cleansing		
No	1	
Yes	**5.88 (1.17-29.50)**	**0.031**
Utilisation des produits antiseptiques		
No	1	
Yes	0.16 (0.02-1.41)	0.101

Figure.2 Frequency of isolated and mixed strains in the study population



Gardnerella vaginalis : G. vaginalis; C. spp : Candida spp ; Staphylococcus aureus : S. aureus ; Mobiluncus spp : Mob. Spp; Staphylococcus spp: Staph. Spp; Trichomonas vaginalis: T. vaginalis.

Figure.3 Frequency of pairs of germs in cases of mixed infections in the study population



Gardnerella vaginalis: G. vaginalis; C. spp: Candida spp; Mobiluncus spp: Mob. Spp; Staphylococcus spp: Staph. Spp; Trichomonas vaginalis: T. vaginalis.

Among these mixed infections, the *G. vaginalis/Candida spp* association was the most represented (41.4%), followed by the *G. vaginalis/Mobiluncus spp* couples (20.8%), *G. vaginalis/Candida spp/Mobiluncus spp (13.8%), G. vaginalis/Mobiluncus spp/Staphylococcus spp* (10.4%), and the *G. vaginalis/T. vaginalis, G. vaginalis/Staphylococcus spp* and *G. vaginalis/Candida spp/Staphylococcus spp* couples with 3.4% each. Indeed, Tchelougou (2012) obtained similar associations: *G. vaginalis/Candida spp* (88.24%), *G. vaginalis/T. vaginalis* (5.9%), *Candida spp/Staphylococcus spp* (3.9%), *G. vaginalis/Candida spp/ Mobiluncus spp* (2%). Regarding the gestational age, 63.6% were in the first trimester, followed by 33.7% in the second trimester, unlike Leblanc (2008) in Benin (36.1% in the first trimester and 47.2% in the second trimester) and Tchelougou (2012) (35% in the first trimester and 38% in the second trimester). This can be explained by the fact that the majority came as part of prenatal screening. However, patients in the first trimester of pregnancy were more infected with *Staphylococcus spp* (CNS) and had more mixed infections; those in the second trimester were more infected with *S. aureus* and *C. albicans*. However, those in the third trimester were more infected with *G. vaginalis*. This distribution of Staphylococcus strains is different from that obtained by Soho (2020), who found that patients in the third trimester were more infected with *S. aureus*. Similarly, we noticed that the presence of mixed infections decreased from the first to the last two trimesters of pregnancy (but this variation was not statistically significant), as in the case of Tchelougou (2012), in which coinfections increased between the first, second, and third trimesters of pregnancy (these variations being statistically significant).

Regarding complaints and history, the most representative was dyspareunia (27.3%), burning urination, leukorrhea (10.9%), and itching (9.1%). This was different from that obtained by Ngaba *et al.,* (2014) in Douala: itching (44.12), leukorrhea (37.25%), and dyspareunia (4.9%). This could be explained by the fact that these authors worked not only on pregnant women but also on women of childbearing age. Most patients with these complaints had a mixed infection. Similarly, 80% of patients had a previous vulvovaginal infection, 27.3% had a preterm delivery, 23.6% used antiseptic products, and 5.5% had a miscarriage in the past. Participants who previously had a miscarriage or preterm delivery were much more infected with *G. vaginalis*, those who had a previous vulvovaginal infection were much more infected with *C. albicans*; and those using antiseptic products were much more infected with *S. aureus* and mixed infections.

More than half of the participants had an unbalanced vaginal flora (63.6%), 27.3% had a normal vaginal flora, and 9.1% had an intermediate vaginal flora. However, Agbokou *et al.,* (2008) found that 45.4% of their study population had an intermediate vaginal flora and 35.2% had a normal vaginal flora. Most patients with an unbalanced vaginal flora were much more prone to mixed infections and *G. vaginalis*; those with an intermediate vaginal flora were much more infected with *S. aureus*; and some with a normal vaginal flora were prone to *C. albicans*. This high rate of unbalanced flora observed is consistent with the high infection rates found elsewhere. An imbalance in flora would thus favor the proliferation of pathogens.

As for the antibiogram and antifungigram, *Staphylococcus strains* were much more sensitive to Ceftriaxone (100%), Imipenem and Amoxicillin (87.5% each), and Gentamicin (75%). However, they showed resistance to Ceftazidime (75%). Tchelougou (2012) found strains sensitive to Gentamicin and resistant to Amoxicillin and Ceftriaxone. *Candida strains* showed sensitivity to Econazole (95.5%), Miconazole (78.7%), Fluconazole, and Nystatin (74%). They were, however, resistant to Ketoconazole. Ngaba *et al.,* (2014) had nevertheless isolated strains sensitive to Nystatin and Econazole but resistant to Amphotericin B and Fluconazole. These resistances are, no doubt, due to the wide availability of these products and self-medication.

Without neglecting the fact that pregnancy itself is a factor associated with the occurrence of genital infections in women, including vulvovaginitis, we identified two other factors from our study: the use of poorly maintained underwear and improper intimate cleansing. These factors also appear in the physical factors section described by Lévesque *et al.,* (2011). This association between positivity rates and deficient intimate hygiene (underwear, cleansing) suggests that hygiene education measures could prevent some infections.

The objective of this study was to establish the profile of germs involved in vulvovaginitis and associated factors in pregnant women requesting a cytobacteriological examination ("PCV") at the "Si Melon Laboratory" in the city of Yaoundé. The prevalence of *G. vaginalis* and mixed infections obtained show that vaginal infections, particularly vulvovaginitis, could be a health problem for pregnant women. These prevalences were influenced by certain hygiene behaviors, sociodemographic and clinical characteristics. It is necessary to implement comprehensive health education programs aimed at reducing the prevalence of *G. vaginalis* and raising awareness and educating on good hygiene practices during pregnancy, which could help prevent complications and maintain the health and well-being of pregnant women.

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Availability of data and material

All data generated or analyzed in the course of this study are included in this manuscript.

Author's contributions

TMA: carried out the research work and designed laboratory works, SGM: prepared the first draft of the manuscript and participated in revision and formatting of the final version. GEF and CWK: collected data and laboratory works. CTW: revised the manuscript. KDAN: participated at laboratory works and work and revised the manuscript. LRYT, ATD, CFT and GAA conceived the study and revised the final form manuscript. All authors have read, revised and approved the final version of the manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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