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Prevalence and Associated Factors of Vulvovaginal Candidiasis and Trichomoniasis among Women Attending Three Healthcare Facilities in Brazzaville

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Abstract

Vaginal Candida and Trichomonas infections are recurrent and pose a serious public health problem, causing symptoms such as itching, burning of the micturition and vulva, irritation, and abnormal vaginal discharge, thus affecting women's quality of life. Very little data is available in Africa, particularly in the Republic of the Congo. This is one of the first studies to estimate the prevalence of these infections among women consulted at three health centres in Brazzaville (Blanche Gomes, Talangaï, and Cogemo). Two vaginal swabs were taken. The first swab was used for fresh examination and May Grunwald staining, while the second was used for culture to test for candida. Of the 254 vaginal secretion samples analysed, an overall prevalence of 30% of vaginitis was obtained, including 28% of candida and 2% trichomonas. In terms of candida species (28%), 66.20% of cases were identified as *Candida albicans* versus 33.80% for Candida non-albicans. Of the three sites, the highest prevalence of candidiasis was observed at Blanche Gomes (30%), followed by the Cogemo clinic (28.28%) and Talangai hospital (26.96%). Overall, women who performed between 6 and 10 intimate washes per month exhibited a high prevalence of candidiasis (66.66%). These results highlight the extent of candidiasis infection and hygiene practices as potential risk factors influencing the distribution of these infections in this population.

Keywords

Prevalence-Trichomoniasis, Vulvovaginal Candidiasis, Women, Vaginitis

Infection

1. Introduction

Vaginitis is an inflammation or infection of the vagina. Women frequently consult gynaecologists and obstetricians due to the recurrent vaginal discomfort it causes [1]. It is the most common lower genital infection, caused mainly by Trichomonas vaginalis, Candida albicans, and bacteria [2] Among women with symptoms of vaginitis, the most common infections are Candidiasis. Namely candidiasis (17% - 39% of cases), vaginal bacteriosis (22% - 50%), and trichomoniasis (4% - 35%) [1]

vulvovaginal candidiasis is an infection caused by yeasts of the genus Candida, of which the most frequently isolated species is Candida albicans. Contaminated almost exclusively endogenously, vulvovaginal candidiasis (VVC) is the second most common cause of vaginal infection after bacterial vaginosis. During the childbearing years, 75% of women experience at least one or two episodes of CVV, depending on pregnancy and sexual activity. Highly recurrent, 4% to 8% suffer recurrences of the disease [3]. Candidiasis affects between 138 and 140 million women worldwide according to the World Health Organization (WHO) [4]; their prevalence in tropical Africa varies between 33% and 47% of opportunistic infections [4] [5]. The most common clinical manifestations of VVC are pruritus, hyperemia, vaginal discomfort, profuse and foul-smelling leucorrhoea, abnormal vaginal discharge, burning, pelvic pain, vaginal and vulvar erythema, itching, irritation, dyspareunia and vaginal odour. The most common predisposing factors in the host are uncontrolled diabetes mellitus, antibiotic therapy, sexual activity, immunosuppression, pregnancy and hormone replacement therapy [6] [7].

Vulvovaginal trichomoniasis is a parasitosis caused by Trichomonas vaginalis. It is the most common non-viral sexually transmitted infection in the world. In 2020, approximately 156 million new cases of *T. vaginalis* infection were reported among individuals aged 15 to 49 years [8] [9], corresponding to a prevalence of 5.3% in 2016, representing almost half of the prevalence recorded in that year. [9]. In women, it is the third most common cause of vaginitis, after bacterial and candidal vaginitis, with a prevalence ranging from 2% to 48% [10]. The spectrum of the disease ranges from around 10% - 50% of asymptomatic carriers to individuals with profound acute inflammatory disorders [11]. This protozoan lives in the vagina, particularly the cervix, in women, and in the urethra, prepuce and prostate in men, and causes complications such as vaginitis, miscarriage in women and urethritis in men. Trichomoniasis can increase the risk of HIV transmission. In addition, co-infection with T. vaginalis and HIV can increase infertility in men by reducing sperm motility and survival. This parasite is more prevalent in countries with poor sanitary conditions and tropical climates [12]. Numerous risk factors (behavioral and demographic) are linked to trichomoniasis prevalences [13], in-

cluding age, race/ethnicity, education, residence, marital status, number of sexual partners, sharing of sanitary towels, any drug use, history of sexually transmitted diseases [13].

In Congo, studies on candidiasis and trichomoniasis are scarce, leading to a lack of scientific data on their epidemiology. This shortage of information regarding their origin, transmission, biomedical analyses, and treatment contributes to the complexity of their management and prevention. In view of the above, the aim of this study was to determine the prevalence of candidiasis and trichomoniasis in women, the clinical presentation, and mycological and parasitological characteristics. The risk factors for women attending the three health facilities (Hôpital de Référence de Talangaï, Clinique COGEMO, and Hôpital Spécialisé Mère-Enfant Blanche GOMEZ) in Brazzaville were also estimated.

2. Material and Method

2.1. Type, Period, and Study Site

This was a descriptive and analytical cross-sectional study conducted at the Hôpital de Référence de Talangaï, the Clinique COGEMO, and the Hôpital Spécialisé Mère-Enfant Blanche GOMEZ in Brazzaville (**Figure 1**) over a five-month period, from November 20, 2023, to April 20, 2024. The study included 254 consenting women. These hospitals were selected because they represent

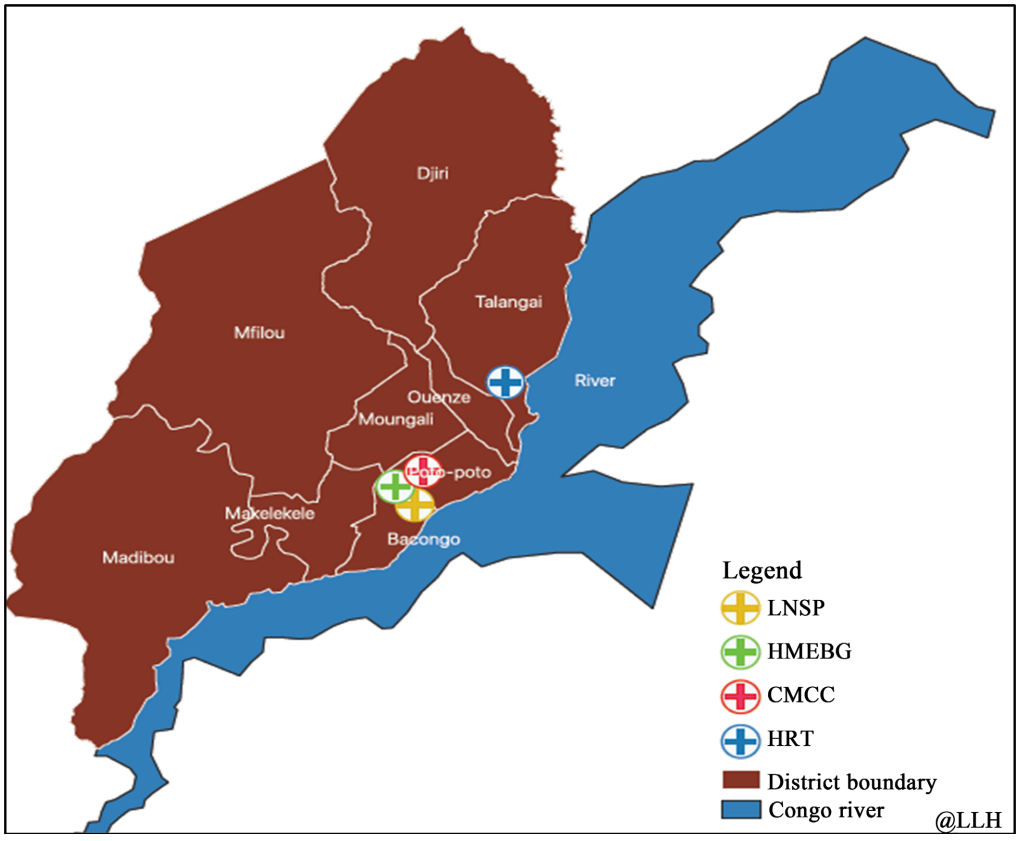

Figure 1. Brazzaville map showing study districts and sites.

diverse healthcare profiles, allowing the recruitment of a wide range of patients. They are also located in areas that provide relatively easy access to healthcare for different population groups and are equipped with biological analysis laboratories that include parasitology and mycology departments.

2.2. Population Studied

The study included women aged 16 to 55 years who attended consultations in the laboratories of the participating institutions, for whom a biological examination of a vaginal sample had been prescribed and performed in the parasitology laboratories of the study sites. All participants provided written or oral informed consent to participate in the study.

2.3. Study Conduct

The inclusion and interviewing of women presenting at the study sites were conducted consecutively. For each patient, a data collection form was fully completed using a questionnaire gathering sociodemographic and clinical information, whether or not she presented symptoms related to the two studied infections.

Demographic and medical-gynaecological characteristics of patients

Variable sociodemographique**:** age, marital status, neighbourhood.

Variables medical-gynaecological variables or clinic: (quantity, colour and odour of secretions, antibiotic therapy, number of intimate toilets performed per month and product used, reason for consultation, antibiotic intake, pregnancy, and type of underwear worn).

2.4. Laboratory Procedure

2.4.1. Sample Collection

Vaginal secretions were collected as follows: the patient was positioned in the gynaecological position. A sterile speculum is inserted, and then a swab is used to collect samples from the cervix, vaginal cul-de-sacs and vagina.

Sterile speculum sampling is used to explore the vagina and cervix for inflammatory lesions and abnormal secretions. However, for the purposes of this study, it was not used in virgin and pregnant women, to preserve the integrity of the cervix and avoid defloration.

Two swabs were used: one for direct microscopy and staining and the other for culture on Sabouraud's medium for yeast culture. One millilitre (1 ml) of normal saline was immediately added to the tube for fresh examination and staining.

2.4.2. New Examination

The purpose of the fresh examination was to detect T. vaginalis, identifiable by its mobility, as well as budding yeast and mycelial filaments. A drop of the first swab tube was placed on a glass microscope slide, covered with a coverlip, and examined under the microscope within 10 to 30 minutes of collection, at the ×40 objective.

1) Yeast culture

The secretion collected with the second swab is seeded in a petri dish containing Sabouraud culture medium with added chloramphenicol, making tight ridges at the north pole of the dish, and spacing the ridges as they reach the south pole. Place the dish in an oven at 37˚C and cheque the culture after 24 hours.

2) Blasmesis test (filamentation)

Measure 200 to 400 µl of serum, collect 2 to 3 yeast colonies from the petri dish using a hanse, place in the serum-containing tube, stir and incubate for 3 hours at 37˚C in the oven, read a drop of the suspension between slide and coverslip under the microscope using an objective ×40 to detect mycelial filaments formed by *c. albicans* in the serum. Albicans in serum [14]. *C. albicans* frequently develops a germ tube from yeast, without constriction at the base, observable under the light microscope in around 90% of cases. Serum favors the formation of invasive hyphal forms [15]. This test was performed to identify Candida of the albicans species [16].

3) Trichomonas vaginalis staining

If mobile or degenerate T. vaginalis is detected on fresh examination, May-Grunwald-Giemsa staining is performed using the following procedure.

Vaginal secretion is spread by placing a drop of saline solution on a glass slide and allowing it to air-dry. The slide is then fixed with May Grunwald fixative or in methanol for 2 minutes, rinsed thoroughly, and then covered with Giemsa for 10 minutes before rinsing again. Finally, the preparation is observed under the microscope with an X100 objective, between the slide and the coverslip [14] [17].

2.5. Ethical Considerations

The study received ethical approval from the institutional ethics committee of the Congolese Foundation for Medical Research (FCRM), referenced under mail number: 068/CEI/FCRM/PR/09/2023. The health authorities of the hospitals and the managers of the institutions involved in the sampling and analysis were informed and gave their consent to the study. Individual information from the participants was analysed in compliance with ethical standards and confidentiality, without taking their identity into account.

Samples taken from consenting patients in each hospital were forwarded to the National Public Health Laboratory for analysis.

2.6. Statistical Analysis

The data were entered from an Excel file version 2022 and implemented in the R software (version R 4.5.2), using the readxl package. The outcome variables were candidiasis and trichomoniasis, and the qualitative explanatory variables were categorised age, marital status, pregnancy, antibiotic therapy, underwear material, intimate hygiene product, frequency of intimate hygiene, and towel sharing. A descriptive analysis was performed to characterise the study population using the describe function of the Hmisc package, and the summary and sd functions were

used for this step. Two multivariate logistic regression models were constructed with candidiasis as the dependent variable and descriptive analysis using Fisher's exact tests for trochomonasis. For each model, the adjusted ORs were calculated by exponentiating the regression coefficients. The 95% confidence intervals were estimated using the Wald method (±1.96 standard deviation). The results were presented in the form of tables of adjusted ORs with their 95% CIs. The statistical significance threshold was set at $p < 0.05$ for all analyses.

3. Results

The socio-demographic characteristics of the 254 women participating in the study are listed in Table 1.

Table 1. Social demographic characteristics.

Socio-demographic factors	Number/N	Percentage (%)
Number of cases = 254		
Age		
[16 - 19]	21	8.26
[20 - 29]	111	43.70
[30 - 39]	78	30.70
≥40	44	17.32
Marital status		
Married	600	23.62
Unmarried couple	17	6.69
Single	177	69.69
Pregnant woman		
Yes	44	17.32
No	210	82.68
Antibiotic therapy		
Yes	37	14.56
No	217	85.43
Underwear material		
Naturel	86	33.86
Synthetic	168	66.14
Intimate hygiene product		
Bactericide	46	18.11
Antifungal	9	3.54
Bactericide/antifungal	40	15.74
Single water	157	61.81

Continued

Herbal tea	2	0.78
Number of intimate toilets		
≤5	180	70.86
6 - 10	6	2.36
Forgotten	68	26.77
Towel sharing		
Yes	71	27.95
No	183	72.05

The average age was 30.6 ± 9.2 years. Women aged 20 to 29 were the most represented, with a percentage of 43.70%. The percentage of single women (69.69%) was higher than that of married women (23.62%) and unmarried couples (6.69%). The percentage of pregnant women (17.32%) was lower than that of non-pregnant women (82.68%). The majority of women were not taking antibiotics (85.4%), while 14.6% were. With regard to the type of undergarment used by the women, those who used synthetic were the most represented, at 66.14%. The products used for intimate hygiene by these women were of various types (bactericides, antifungals, herbal teas), although 61.81% used plain water. Women who showered ≤ 5 times a month accounted for 70.86%. The percentage of women using shared towels (27.95%) was lower than those not using shared towels (72.05%).

3.1. Overall Prevalence of Infections

Figure 2 shows that the combined prevalence of vulvovaginitis caused by Candida and Trichomonas vaginalis is 30% (76/254 cases). *C. albicans* is the most frequently incriminated, accounting for 18.50% of cases, followed by *Candida non-albicans* at 9.45%, and *T. vaginalis* is identified in 2.0% of cases.

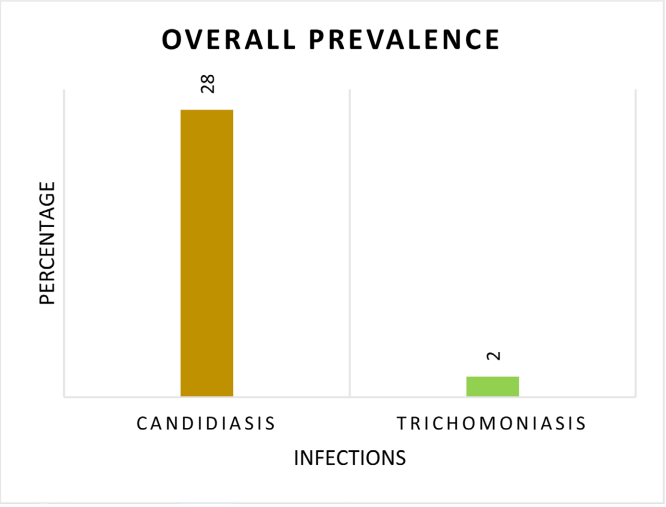

Figure 2. Prevalence of vulvoviginal candidiasis and trichomoniasis.

3.2. Prevalence of Candidiasis and Trichomoniasis by Site

Varying prevalence rates were observed at different sites. The highest prevalence was found at the Talangaï Referral Hospital, with 26.96% of women infected with candidiasis (31/115) and 2.61% with trichomoniasis (3/115). At the COGEMO Clinic, the prevalence of candidiasis and trichomoniasis was 28.28% (28//99) and 1.01% (1/99), respectively. Finally, at the Blanche Gomez Mother-Child Specialized Hospital, the prevalence was 30% for candidiasis (12/40) and 2.50% for trichomoniasis (1/40); without a statistically significant difference.

3.3. Sociodemographic Characteristics and Type of Infection

3.3.1. Candidiasis and Risk Factors

Table 2 shows the prevalence of candidiasis according to the characteristics of the participants. The general prevalence of candidiasis was 27.95%. No significant association was observed ($p \geq 0.05$) between vaginal yeast infection and age.

Table 2. Relationship between candidiasis and risk factors

	Candidiasis			
Infection Risk factors	**Negative Frequency (%)**	**Positive Frequency (%)**	**P-value**	**Odds Ratio 95% CI**
Age				
≥40	31 (70.45)	13 (29.55)	Reference	Reference
[16 - 19]	13 (61.90)	8 (38.10)	0.869	1.10 (0.35; 3.45)
[20 - 29]	81 (72.9)	30 (27.03)	0.47	0.738 (0.32; 1.69)
[30 - 39]	58 (74.35)	20 (25.64)	0.26	0.60 (0.24; 1.48)
Matrimonial status				
Single	129 (72.88)	48 (27.12)	Reference	Reference
Married	41 (68.33)	19 (**31.66**)	0.75	0.89 (0.43; 1.84)
Unmarried couple	13 (76.47)	4 (23.53)	0.26	0.45 (0.10; 1.85)
Pregnant woman	26 (59.09)	18 (40.90)	0.0091	2.87 (1.29; 6.33)
Antibiotic therapy	25 (67.57)	12 (32.43)	0.23	1.64 (0.72; 3.70)
Underwear material				
Naturel	59 (68.60)	27 (31.40)	Reference	Reference
Synthetic	124 (73.81)	44 (26.19)	0.44	0.78 (0.41; 1.47)
Intimate cleansing product				
Single water	33 (73.3)	12 (26.7)	Reference	Reference
Bactericide	6 (66.7)	3 (33.3)	0.78	0.89 (0.38; 2.05)
Antifungal	28 (70)	12 (30)	0.49	1.71 (0.37; 7.98)
Bactericide/antifungal	115 (73.2)	42 (26.8)	0.92	1.04 (0.46; 2.53)
Herbal tea	1 (50)	1 (50)	0.26	5.28 (0.29; 96.23)

Continued

Number of intimate toilets/months				
≤5	137 (76.11)	43 (23.88)	Reference	Reference
6 - 10	2 (33.33)	4 (66.66)	0.06	6.24 (0.95; 41.06)
Forgotten/uncertain	44 (64.70)	24 (35.30)	0.19	1.59 (0.80; 3.15)
Towel sharing	50 (70.42)	21 (29.68)	1.00	1.00 (0.50; 1.97)

However, it is notable that the youngest age group (16 - 19 years) had the highest prevalence (8/21; 38.09%). In terms of marital status, married women had the highest prevalence of vaginal mycotic infestation (19/60; 31.67%), followed by single women (48/177; 27.12%) and unmarried women in couples (4/17; 23.53%). However, no significant differences were observed (p = 0.860). Pregnancy was found to be the factor associated with candidiasis (p = 0.028), with a prevalence of 40.91% (18/44) in pregnant women. In contrast, antibiotic therapy showed no statistically significant difference with vaginal yeast infection (p = 0.27). Women using synthetic underwear had a prevalence of candidiasis of 26.19% (44/168), with no statistical difference (p = 0.34). The nature of the product (bactericide, antifungal and herbal tea), the use of plain water for intimate toilets was not significantly associated with the occurrence of candidiasis (p ≥ 0.05). The number of intimate toilets per month appeared to be a factor that statistically approximated candidiasis. Women whose number of intimate washes per month was ≥6 showed a high prevalence (66.66%), with a p-value slightly above the threshold of statistical significance (p = 0.06), compared with women whose number was ≤5, among whom the prevalence was 23,88%. Women using shared towels had a prevalence of 29.68% (21/71 women), with no significant statistical difference (p = 1.00).

3.3.2. Prevalence of Trichomoniasis by Participant Characteristics

Table 3 shows the prevalence of trichomoniasis according to the characteristics of the participants. The general prevalence of trichomoniasis was 2% (5 positive cases). The 20 - 39 age group showed a 2.70% (n = 3) prevalence of trichomoniasis slightly to other age groups; no statistically significant difference was observed (p = 0.90) Pregnancy showed no statistically significant result for trichomoniasis (p = 0.38), with a prevalence of 2.27% in pregnant women. Antibiotic therapy showed no statistically significant difference regarding trichomoniasis (p = 0.55), nor did underwear material (p ≥ 0.05). The number of intimate toilets per month showed no association with trichomoniasis (p ≥ 0.05). Women who used only plain water for intimate hygiene had a trichomoniasis prevalence of 1.90%, with no statistically significant difference, whereas those who used bactericidal products had a prevalence of 2.17%. With regard to the use of shared towels, women who used them had a prevalence of 1.41%, compared with 2.2% in those who did not use shared towels—no statistical difference was observed (p = 1.00).

Table 3. Relationship between trichomoniasis and various risk factors

	Candidiasis		
Infection Risk Factors	**Negative N (%)**	**Positive N (%)**	**P-value**
Age			
≥40	43 (97.77)	1 (2.23)	0.90
[16 - 19]	21(100.00)	0 (0.00)	
[20 - 29]	108 (97.30)	3 (2.70)	
[30 - 39]	77 (98.70)	1 (1.30)	
Matrimonial status			
Single	173 (97.74)	4 (2.26)	1.00
Married	59 (98.33)	1/60 (1.77)	
Unmarried couple	17(100.00)	0 (0.00)	
Pregnant woman	43 (97.73)	1 (2.27)	1.00
Patient taking antibiotics	36 (97.30)	1 (2.70)	0.55
Underwear material			
Naturel	83 (96.51)	3 (3.48)	0.34
Synthetic	166 (98.81)	2 (1.19)	
Intimate cleansing product			
Single water	154(98.10)	3 (1.90)	1.00
Bactericide	45 (97.83)	1 (2.17)	
Antifungal	9 (100.00)	0 (0.00)	
Bactericide/antifungal	39 (97.50)	1 (2.50)	
Herbal tea	2 (100.00)	0 (0.00)	
Number of intimate toilets			
≤5	177 (97.79)	4(2.21)	0.09
≥6	4 (80.00)	1 (20.00)	
Forgotten/uncertain	67 (100.00)	0 (0.00)	
Towel sharing	70 (98.59)	1 (1.41)	1.00

3.3.3. Identification of Candida Species

The culture results on Sabouraud medium allowed us to isolate colonies identified as yeasts responsible for vulvovaginal candidiasis, representing a prevalence of 27.95% in all samples studied.

The filamentation or blastesis test showed that of the 71 isolates of candida, *Candida albicans* predominated with 47 strains, representing 66.20%, against *Candida non-albicans* with 24 strains, or 33.80%.

3.3.4. Distribution of Women According to Reported Symptoms

1) Symptoms reported for candidiasis

Among women with candidiasis, 34.57% had copious vaginal discharge, a highly significant association (p = 0.00037), indicating that this clinical sign is strongly linked to candidiasis. Similarly, in women with yellowish discharge, the prevalence of candidiasis reached 50%, with a significant p-value (p = 0,03), suggesting a statistically robust association between this discharge characteristic and the presence of candidiasis.

Furthermore, a high prevalence of candidiasis (41.76%) was observed in women experiencing pruritus or itching; however, the p-value, slightly above the significance threshold (p = 0.07), indicated no statistically significant association between this symptom and the infection. But reinforcing its importance as a suggestive clinical sign. Additionally, burning during urination also appears to be a factor associated with candidiasis, with a prevalence of 47.79%. However, since the p-value (0.154) is above the significance threshold, this association is not statistically significant. Finally, 26.23% of women with candidiasis had foul-smelling secretions (p = 0.09), as shown in Table 4.

Table 4. Different symptoms and candidiasis.

Symptoms	Negative (%)	Positive (%)	Total	P-value	Odds Ratio 95% CI
Urinary burning	39 (58.21)	28 (**47.79**)	67 (100)	0.15	1.69 (0.82; 3.50)
Pruritus	53 (58.24)	38 (**41.76**)	91 (100)	0.07	1.87 (0.94; 3.70)
Smell of secretion	45 (73.77)	16 (26.23)	61 (100)	0.09	0.52 (0.24; 1.10)
Colour of secretion					
Whitish	157 (75.12)	52 (24.88)	209 (100)	Reference	Reference
Brown	3 (60.00)	2 (40.00)	5 (100)	0.57	1.79 (0.25; 12.33)
Greenish	3 (100)	0 (0.00)	3 (100)	0.99	0 (0; inf)
Yellowish	15 (50.00)	15 (**50.00**)	30 (100)	0.03	2.62 (1.11; 6.17)
Hematic	5 (71.42)	2 (28.57)	7 (100)	0.43	2.15 (0.31; 14.36)
Quantity of secretions					
Minimise	60 (90.90)	6 (9.10)	66 (100)	Reference	Reference
Abundant	123 (65.43)	65 (34.57)	188 (100)	0.00037	5.24 (2.16; 14.20)

2) Reported symptoms of trichomoniasis

Among women with trichomoniasis infection, 2.99% suffered from urinary burning, 2.20% suffered from pruritus, 4.92% of these women had poorly-smelling secretions, 33.33% had greenish secretions, predominating over other colors, and 2,13% of women had abundant secretions. There was no statistically significant difference (p ≥ 0.05) for any of these symptoms (Table 5).

Table 5. Symptoms and trichomoniasis.

Symptoms	Negative (%)	Positive (%)	Total	P-value
Urinary burning	65 (97.01)	2 (2.99)	67 (100)	0.61
Pruritus	89 (97.80)	2 (2.20)	91 (100)	1,00
Smell of secretion	58 (95.08)	3 (4.92)	61 (100)	0.09
Color of secretion				
Whitish	207 (99.04)	2 (0.96)	209 (100)	0.01
Brown	5 (100)	0 (0)	5 (100)	
Greenish	2 (66.67)	1 (33.33)	3 (100)	
Yellowish	29 (96.67).	1 (3.33)	30 (100)	
Hematic	6 (85.71)	1 (14.29)	7 (100)	
Quantity of secretions				
Minimise	65 (98.48)	1 (1.56)	66 (100)	1,00
Abundant	184 (97.87)	4 (2.13)	188 (100)	

4. Discussion

The present study contributes to understanding the impact of vulvovaginal candidiasis and trichomoniasis. Its aim was to determine the prevalence of these infections in women attending three health centers in the city of Brazzaville, and to establish the link between certain socio-demographic factors and hygiene habits in this population. Vaginitis is a worldwide problem and is common among sexually active women [15].

The general prevalence of candidiasis and vaginitis of trichomoniasis in the three sites was 30%. No candido-trichomoniasis co-infection was found in these women. As far as vulvovaginal candidiasis (VVC) is concerned, it is very common in women of childbearing age, with a prevalence ranging from 12% to 72% [16]. The prevalence of VVC among women consulting at the three sites was 28%. Our results are close to those found in Cameroon (27.27%) [17] and in Gabon (28.52%) [18]. Although the observed prevalence falls within the range reported by Anh *et al.*, 2021 [16], it was lower than those reported in Ethiopia (41.4%) [19], in Lebanon (39%) [20] and in Côte d'Ivoire (43%) [21]. In contrast, it is higher than that found in another study in Cameroon, 11% [22], The differences in prevalences observed can be attributed to differences in data collection methods, regional variations, as well as socio-economic, and socio-demographic differences in the populations studied.

The average prevalence of candidiasis at the three sites was 28.4%. It should be noted that the prevalence of candidiasis at each site was around this average. This similarity could be attributed to the uniformity of the population studied at the three sites, *i.e.*, the risk factors are distributed relatively evenly among the population of women consulting these sites. It should be noted that Blanche GOMEZ

has a slightly higher prevalence of VVC among its patients compared to the other two sites, with a percentage of 30%, which is thought to be due to the high percentage of pregnant women. The percentage of pregnant women at Blanche GOMEZ was 39.50%, compared to 17.20% at the COGEMO Clinic and 10.30% at Talangaï.

The mean age in our study was 30.6 ± 9.2 years, corroborating the ages of the studies carried out in Benin, 29.83 years [2], Morocco, 31.82 years [23] and Tunisia, 32.47 years [24]. This is in fact an age corresponding to the full period of sexual activity, a period during which Candida proliferation is facilitated by an imbalance in the genital flora, whether due to sexual or hormonal activity. The prevalence of VVC was 27.03% in 20-29-year-olds, 25,64% in 30-39-year-olds, and 29.55% in women aged 40 and over. It was highest, reaching 38.10%, among women aged 16 - 19. With no significant statistical difference ($p \geq 0.05$), these results are similar to the study carried out in southern Poland, where VVC were more prevalent in the 15 - 20 age group, at 32.3% [25], which could be explained by the transition from adolescence to adulthood, when hygiene conditions can be precarious and the level of education lower. Despite this, candidiasis was detected in all age groups, showing that this infection can affect all age categories.

VVC is significantly higher among women, regardless of their marital status: 31.66% among married women, 23.53% among women in unmarried relationships, and 27.12% among single women. The prevalence of 31.66% among married women is close to that found (31.6%) [26]. These high prevalence rates could be explained by several factors. Among women in relationships or married women, sexual intercourse may be a major cause, while among single women, the risk of infection may be increased due to the possibility of multiple sexual partners [27].

Pregnancy is the leading factor contributing to VVC [28]. The prevalence of VVC among pregnant women was 40.90% ($p = 0.028$). Our results corroborate studies conducted in Benin 68.63%, [4], in Cameroon 35.52% [29], in Togo 30.77% [30], as well as in another previous study conducted in Benin [2], where the prevalence of VVC among pregnant women was high. These high prevalences could be related to the hormonal imbalance of pregnancy, particularly the increase in progesterone. This alters the vaginal epithelium, lowers the pH, and promotes the implantation of yeast. Progesterone also increases the glycogen content of the vaginal subepithelial tissue, creating an environment conducive to yeast growth and germination [6].

The prevalence of VVC among women who did not receive antibiotic therapy was higher than among those who received antibiotic therapy (32.43% vs. 67.57%), but the difference was not statistically significant ($p = 0.23$).

Women wearing synthetic underwear showed a lower prevalence of VVC (26.19%) compared to those wearing natural-fabric underwear (31.40%). Our study also reported a lower prevalence among women using synthetic materials than that observed in Cameroon, where a prevalence of 36.17% ($p = 0.005$) was

found among women wearing tight synthetic underwear [29]. Conversely, it corroborates a study also conducted in Cameroon, in which the wearing of excessively tight or synthetic underwear was identified as the most frequently associated factor, with a prevalence of 27.71% among women diagnosed with candidiasis [29]. These garments restrict ventilation and increase local temperature, thus promoting an environment conducive to Candida growth [31].

Frequent intimate hygiene or the use of antiseptics can alter the epithelium and its lining, change the local pH, and alter the balance of the natural flora. This increases the risk of bacterial or fungal colonisation [32]. Women whose frequency of intimate hygiene practices was 6 - 10 times per month were more at risk of VVC, with a prevalence of 66.66%, although the p-value was slightly above the significance threshold ($p = 0.06$). Our results corroborate the study conducted in Benin, where women who washed their intimate areas more than twice per day had a prevalence of 63.64% [4].

The prevalence of vulvovaginal candidiasis was almost equivalent among women using bactericides (33.33%), antifungals (30%), or a combination of bactericide/antifungal (26.8%). However, it was lower among those using plain water for douching (26.66%), with no statistically significant difference ($p \geq 0.05$). These high prevalence rates can be explained by the uncontrolled use of these products, which promotes the proliferation of commensal and opportunistic organisms. The high prevalence among women using bactericides may be explained by the destruction of the normal vaginal bacterial flora. Vulvovaginal candidiasis (VVC) is mainly characterized by heavy vaginal discharge and itching [21].

Vulvovaginal candidiasis (VVC) is characterised mainly by heavy vaginal discharge and itching [21]. The prevalence of VVC was significantly higher in women suffering from pruritus (41.76%, $p = 0.07$), burning during urination (47.79%, $p = 0.15$) Without statistically significant difference, and women with heavy vaginal discharge (34.57% et $p = 0.00037$). Our results corroborate those found in Côte d'Ivoire, where the clinical symptoms of VVC were dominated by burning during urination (71.4%) and vulvar itching (48.2%) [33]. Women with yellowish discharge showed a VVC prevalence of 50%. Our results corroborate studies conducted in Burkina Faso, where the prevalence was significantly higher among symptomatic women (58.02%) [30], as well as a study conducted in Benin, where the prevalence was 56.25% among women with abundant secretions [4]. However, the odor of secretions was less prevalent (26.23%) in cases of VVC. The low prevalence of odor of secretions compared to other symptoms could be explained by the failure of some women to follow the recommendations for preparation before sampling, as they wash their genitals while showering before going to the laboratory for vaginal sampling, thus dissipating the characteristic odor of VVC.

Among the 71 yeast strains isolated in our study, *c. albicans* was the most isolated species with 66.20% compared to 33.80% of non-albicans Candida. Our results are consistent with those of several studies elsewhere where *c. albicans* pre-

dominates, 78.2% in Mali [34], 58.6% in Ethiopia [19], 69.2% in Morocco [23], 72.6% in Ivory Coast [33], 42% in Lebanon [20], 81.16% in Tunisia [24], and 96.1% in Benin [2]. This predominance is thought to result from the commensal nature of *c. albicans* in the digestive and genitourinary tracts. According to some authors, *c. albicans* is more sensitive to variations in estrogen hormones (found in vaginal candidiasis) [2] [21]. Despite this predominance, non-albicans species such as *C. glabrata*, *C. krusei*, *C. parapsilosis*, *C. tropicalis* and *C. dubliniensis* are emerging [35]. The prevalence of 28% of candidiasis in the study and the symptoms observed highlight Candida as the main pathogen. This confirms that vulvovaginal candidiasis (VVC) remains a widespread infection that affects a large number of women each year [30].

Trichomonas vaginalis is a of the leading causes of infectious vaginitis, affecting approximately 244.90 million people in 195 countries. This infection poses a significant risk of vaginitis and is classified as the second most common sexually transmitted infection [36]. The prevalence of trichomoniasis was 2%. This result corroborates studies conducted by [37] in Gabon (2.1%), [15] in Cameroon (2%), in Wuhan, People's Republic of China (2.84%) [38], in Senegal (3.07%) [10], in Tunisia (3.5%), and is slightly lower than the prevalence found in Togo (6.5%) among sex workers. In contrast, high prevalence rates have been reported in other studies, 16.3% in Cameroon [39], 54% in Iraq [40], and 45% in a population of men and women in Nigeria [41]. The variations in prevalence observed in these studies can be explained by several factors, including sociodemographic characteristics and the methodology used, in particular the varied selection of the populations studied and the different diagnostic techniques. Our study randomly included women who came for consultations at these sites, unlike other studies targeting specific groups including men and women and taking into account various samples such as urine, semen, and vaginal secretions.

The prevalence of trichomoniasis at each site was approximately the average prevalence of trichomoniasis, *i.e.*, 2%. The similarity in these prevalences could be explained by the uniformity of the study population at the three sites. The sociodemographic factors associated with trichomoniasis are debatable. Numerous studies have reported an association between the risk of *T. vaginalis* infection and certain risk factors [13].

In this study, although the statistical results were not significant for the factors considered, T. vaginalis was detected more frequently in women aged 20 to 39, representing a prevalence of 2.34%. The infection observed among these women could be explained by high sexual activity, limited education regarding sexually transmitted infections (STIs), insufficient protection due to non-use of condoms, and multiple sexual partners. Furthermore, marital status, shared towel use, and type of underwear showed no statistically significant differences, with p-values well above the significance threshold ($p > 0.05$) (**Table 3**).

Regarding pregnancy, it was not statistically significant in this study ($p = 1.00$) with a prevalence of 2.27%. These results corroborate those found in a regional

hospital in Cameroon, with a prevalence of 2% [15], as well as in a general population of women in a prospective study conducted in 2011 in Togo among 302 pregnant women, where the prevalence was 3.7% [42]. In contrast, the prevalence of trichomoniasis was higher in studies conducted in Kenya, Nigeria, and South Africa, where the prevalences were 35.4%, 18.7%, and 15.0%, respectively. Despite its low prevalence, trichomoniasis should not be overlooked due to its impact on the reproductive health of infected women. It can cause pelvic pain and irritation of the urogenital tract, which can lead to serious complications such as infertility, premature rupture of the placental membranes (risking premature delivery), low birth weight, and even neonatal mortality [43]. Furthermore, in this study, large numbers of Trichomonas vaginalis were found in the vaginal secretions of a pregnant woman who was close to miscarriage.

With regard to the number of intimate washes per month, the prevalence of trichomoniasis was 2.21% and 20% in the ≤5 and 6 - 10 categories, respectively. Intimate washing can cause an imbalance in the vaginal flora, Physiological changes, particularly pelvic vascularization and estrogenic activity on the vaginal epithelium, cause the growth, maturation, and exfoliation of squamous cells and an increase in glycogen deposits in vaginal epithelial cells, which promotes the establishment, multiplication, and transmission of the parasite [11].

Trichomoniasis in women usually begins with yellow or greenish, foamy, foul-smelling vaginal discharge. In some cases, the discharge is light. The genital area can be irritated and sensitive, and sexual intercourse may be painful. In severe cases, urination can be painful or frequent [44]. Burning during urination, itching, and the amount and colour of discharge did not show a significant prevalence of trichomoniasis. The lack of association between symptoms and infection could be explained, first, by the low prevalence of trichomoniasis in the study population. Secondly, the symptoms of trichomoniasis vary in intensity and many infected individuals often remain asymptomatic. The infection can affect between 10 and 50% of carriers, ranging from asymptomatic cases to individuals with severe acute inflammatory disorders [11].

5. Conclusions

Vaginal infections remain a major health problem for women of reproductive age. The study shows that candidiasis is common (28%), unlike trichomoniasis (2%).

The results indicate that vaginal candidiasis is primarily caused by Candida albicans (66.20%). This distribution is consistent with data from the literature. The most frequent clinical symptoms, such as itching, burning mucus, and abundant, yellowing vaginal discharge, are reliable indicators of vaginal candidiasis. However, these manifestations are not specific and can also be observed in other vaginal infections. Candidiasis particularly affects pregnant women and has a high prevalence associated with other factors, including poor intimate hygiene and the wearing of synthetic underwear. It is therefore important to better understand these factors in order to improve prevention and women's intimate health.

6. Study Limitations

The limitations of this study must be considered when interpreting the results. First, the low prevalence of trichomoniasis observed led to instability in the estimates during the logistic regression analyses; therefore, Fisher's exact test was used instead for some comparisons.

Furthermore, the diagnosis of trichomoniasis relied solely on wet mount examination between a slide and coverslip, followed by staining of positive cases. This method has limited sensitivity compared to more advanced techniques, such as molecular analyses.

In addition, the lack of identification of non-albicans Candida species is also a significant limitation of this study. The investigations focused solely on candidiasis and trichomoniasis, without considering other genital infections of bacterial or viral origin.

Finally, some variables had missing data, which led to their exclusion from the logistic regression analyses.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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