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Female reproductive tract health: prevalence and risk factors associated with infections in Lomé. (Female reproductive tract infections in Lomé)

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Abstract

Background: Women with female reproductive tract infections (FRTIs) have an increase susceptibility to sexually transmitted infections. In Togo, data are limited on the etiology of FRTIs and especially the associated risk factors.

Objective: This study aimed to determine the prevalence and risk factors associated with vaginal infections in the district hospital of Bè.

Methods: A cross-sectional study was conducted in the medical bacteriology laboratory of the hospital of Bè (Lomé, Togo). From August to October 2016, consented women aged from 18 to 45 years, attending the hospital, to whom cytobacteriological examination of vaginal swabs were performed, were interviewed.

Results: 155 women were enrolled, most of them aged under 30 years old (58.71%). The prevalence of FRTIs was 77.42% with bacterial vaginosis (49.03%) and vulvovaginal candidiasis (40.65%) as the most common. The principal risk factor associated with FRTIs was having had more than one sexual partner in one's lifetime. Use of tampons was significantly associated with bacterial vaginosis.

Conclusion: The results of this study highlight the high prevalence and the potential factors and behaviours that contribute to the occurrence of FRTIs and could thus contribute to the development of suitable messages for awareness campaigns against those infections.

Introduction

The female reproductive tract has a normal microbial flora consisting mainly of bacteria of the genus *Lactobacillus* [1]. These commensal dominant microorganisms deploy antimicrobial mechanisms inhibiting the multiplication of pathogenic germs [2]. This flora may be unbalanced and exogenous or endogenous germs possibly pathogenic can multiply there. Female reproductive tract infection (FRTI), the infection of women reproductive or genital tract causes healthy life loss among sexually active women of reproductive age in developing countries [3]. They are associated with high risks of HIV infection and may be responsible for other consequences such as pelvic pain, premature delivery, infertility, ectopic pregnancy, miscarriage and cervical or uterine cancers [4].

Every day, more than one million people become infected with a sexually transmitted infection (STI) [5]. In Togo, more than 58000 cases of genital infections have been reported and treated in 2015, from which more than 85% were female patients. Vaginal infections account for the largest share of these female genital infections with a rate of 59.4% [6]. These infections mainly affect women in sexual and reproductive activities and are predominant in developing countries [7,8]. The most common risk factors associated with the infection of the vaginal flora are inadequate intravaginal and menstrual hygiene practices (use of sanitary pads, menstrual tampons…) that could alter the pH of the vagina favouring the destabilization of its microbial ecosystem. Other factors such as sexual risk, use of spermicides or contraceptive devices have been reported [9,10]

In Togo, two studies have been conducted recently on FRTIs; they focused on the prevalence of germs involved in pregnant women exclusively [11,12], but less is known about the risk factors in Togo. We have limited data on the aetiology of FRTIs and especially the associated risk factors. This study was conducted to determine the prevalence and risk factors associated with FRTIs in sexually active women.

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Material and methods

Study population characteristics

This cross-sectional study was conducted in the laboratory of medical bacteriology of the hospital of Bè in the capital city of Lomé, Togo, from August to October 2016. In total, 155 consented sexually active women aged from 18 to 45 years old, who came to the laboratory to perform a vaginal swab prescribed by their medical practitioner, were included in this study. Prior to the vaginal swabbing, it was ensured that women were not on anti-infectious treatment, did not practice douching to clean vagina, did not have sex in the last 48 hours and had their last menstrual periods less than 7 days ago. Only participants who gave a written informed consent were enrolled.

Participant data collection

Women were met before their vaginal swab collection and were informed about the study. After giving their written consent, a questionnaire was performed to know about their age, their marital status, their educational level, their age at their first menstrual period, the average of salary per month, their method of vaginal cleansing, their method of menstrual hygiene, the use of contraceptive methods and herb insertion in the vagina. Information obtained from the interview and the results of the vaginal swab examinations were collected on a survey card.

Bacteriological techniques

In total, three vaginal swabs were collected from each woman. One swab (VWR International, Fontenay-sous-bois, France) of endocervical specimen was used for the detection of *Neisseria gonorrhoeae* and two swabs were taken from the posterior vaginal fornix. One was stored in saline medium (for microscopic examinations) and the other swab was platted on culture media in order to detect bacterial and fungal agents that are responsible for vaginal infections.

The fresh microscopic examinations allowed to diagnose *Trichomonas vaginalis* and *Candida sp*, then microscopic examination after Gram staining was performed to diagnose *Gardnerella vaginalis* and *Mobiluncus sp* vaginosis by the Nugent score [13], using optic microscope (Carl Zeiss Microscopy GmbH, München, Germany).

In short, the Nugent score is calculated by assessing for the presence of long Gram-positive bacteria (Lactobacillus morphotypes; decrease in Lactobacillus scored as 0 to 4), small Gram-variable bacteria (*Gardnerella vaginalis* morphotypes), and curved Gram-variable bacteria (*Mobiluncus spp* morphotypes). The combination of these 3 scores determines bacterial vaginosis (BV) as follows:

- 0–3 is considered negative for BV;
- 4–6 is considered indeterminate for BV;
- 7-10 is considered indicative of BV.

Conventional media routinely used in the laboratory of the Hospital of Bè were used for germs isolation. All the media and identification reagents where from Bio-Rad (California, USA). For the diagnosis of *Neisseria gonorrhoeae*, cultures were carried out on chocolate agar plates and incubated for 24 to 48 h at 37°C, under CO_2-enriched atmosphere. Sabouraud-chloramphenicol agar was used for the detection of yeasts and eosin-methylene blue (EMB) agar for the detection of Enterobacteriaceae. In addition, fresh blood agar and CHAPMAN agar were used for the detection of Streptococci and Staphylococci, respectively. All those media were incubated for 24 h at 37°C and additionally, fresh blood agar was incubated under a CO_2-enriched atmosphere.

The identification of strains was done according to the cultural, morphological, biochemical and antigenic characteristics of bacteria or yeasts. *Candida albicans* was identified by filamentation test with human plasma from suspect colonies on Sabouraud-chloramphenicol agar. *Enterobacteriaceae* were identified by their classical bacteriological characteristics (Gram staining, oxidase test) and their biochemical characteristics using identification strips (Kliger-Hajna media, Simmons citrate, mannitol mobility and urea indole). *Staphylococci* and *Streptococci* were identified by their cultural, morphological and antigenic characteristics using classical bacteriology identification methods.

Statistical analysis

SPSS software (IBM SPSS Statistics 21; Armonk, NY) was used to perform Chi-square (χ^2) test and logistic regression analysis. Chi-square test allowed us to assess differences between frequencies (p-value threshold 0.05), then univariate and multivariate logistic regression analysis allowed us to investigate the risk factors associated with FRTIs including the calculation of odds ratios (OR) and adjust odds ratios (aOR) with 95% confidence intervals (CI). A threshold of *p*-value <0.2 and <0.05 were considered for univariate and multivariate analysis, respectively.

Results

Socio-demographic characteristics of the study population

The socio-demographic characteristics are presented in table 1. The mean age of the women was 29.89 ± 6.49 years old. Most of

Table 1. General characteristics of women

Characteristics of women	
Mean age (years)	29.89 ± 6.49
Marital situation, n (%)	
Maried/in relationship	101 (65.2)
Not maried/not in relationship	54 (34.8)
Average length of relationship with current partner (years)	5.80 ± 4.96
Level of education, n (%)	
No education	26 (16.8)
Full Primary school	41 (26.5)
Full Secondary School	48 (31.0)
Post-secondary education	40 (25.7)
Monthlty income (US $), n (%)	
≤ 30	42 (27.1)
32-70	41 (26.5)
72-140	25 (16.1)
Don't earn money	41 (26.5)
>140	6 (3.8)
Average number of pregnancies	1.69 ± 1.68
Mean age at first menstruation (years)	14.82 ± 1.63
Mean age at first sexual intercourse (years)	18.42 ± 3.22
Average number of partners	3.03 ± 1.53

Table 2. Prevalence of FRTIs in women

INFECTIONS	**N (%)**	**95% CI**
Bacterial vaginosis	79 (50.97)	[43.10 – 58.84]
Vulvovaginal Candidiasis	63 (40.65)	[32.91 – 48.38]
Bacterial vaginitis	5 (2.58)	[0.44 – 6.01]
Trichomoniasis	4 (3.23)	[0.08 – 5.08]
FRTIs	120 (77.42)	[70.84 - 84.00]

CI = confidence interval

them (65.2%) were married or cohabiting and the mean length of the relationship with the current partner was 5.80 ± 4.96 years old. The average number of pregnancies in the population was 1.69 ± 1.68. The mean age at first menstruation was 14.82 ± 1.63 years old, the mean age at first intercourse was 18.42 ± 3.22 years old, and the mean number of partners ever had was 3.026 ± 1.53.

Prevalence of female reproductive tract infections (FRTIs)

Out of a total of 155 women diagnosed, the overall prevalence of FRTIs was 77.42 ± 6.58%. Bacterial vaginosis and candidiasis were the most common with prevalence of 49.03% and 40.65% respectively, followed by bacterial vaginitis (3.23%) and vaginal trichomoniasis (2.58%) (Table 2).

Risk factors associated with FRTIs in general

The relationship between socio-demographic characteristics, potential risk factors (women's reproductive health, women's sexual health) and FRTIs screening results (positive or negative) is presented in the table 3.

The prevalence of FRTIs was significantly higher in women that had had more than one sexual partner in their lifetime (p=0.034).

Univariate binary logistic regression analysis revealed lower risk of FRTIs in women who had sex during menstruation (OR = 0.14; 95% CI [0.01-1.58]), who had had sex in the last six months (OR = 0.19; 95% CI [0.65-9.23]); those who used condoms (OR = 0.51; 95% CI [0.21-1.27]), and those who used protection the last time they had sex (OR = 0.43; 95% CI [0.14-1.28]). The risk of RTIs was high for women aged 30-35 years (OR = 2.42; 95% CI [0.83-7.08]) and also for women who introduced products (conventional drugs, traditional medicines) into the vagina (OR = 1.96; 95% CI [0.83-7.08]); 95% CI [0.91-4.22]), those who had had a miscarriage (OR = 4.83; 95% CI [0.97-23.98]) and those who had had more than one sexual partner in their lifetime (OR = 2.60; 95% CI [1.05-6.41]).

After adjusting the above variables, women who had had more than one sexual partner in their lifetime had a higher probability of developing RTIs (aOR = 3.34; 95% CI [1.15-9.70]).

Find in the appendix (Table 8) the complete table of the descriptive and logistic regression analysis of factors associated with RTIs, listing all associated and non-associated, significant and non-significant factors.

Risk factors associated with bacterial vaginosis

The relationship between socio-demographic characteristics, potential risk factors (women's reproductive health, women's sexual

Table 3. Descriptive analysis and logistic regression of risk factors associated with RTIs

	Descriptive analysis			**Logistic regression analysis**			
	Chi-square			**Univariate**		**Multivariate**	
	Negative	**Positive**	**p-value**	**OR (95% CI)**	**p-Value**	**a OR (95% CI)**	**p-Value**
Characteristics	n (%)	n (%)					
Age brackets							
[18 - 25]	13 (37.1)	34 (28.3)	0.26	1		1	
[26 - 29]	6 (17.1)	25 (20.8)		1.59 (0.53-4.77)	0.41	1.42 (0.39-5.21)	0.59
[30 - 35]	6 (17.1)	38 (31.7)		2.42 (0.83-7.08)	**0.11***	2.45 (0.61-9.82)	0.21
[36 - 45]	10 (28.7)	23 (19.2)		0.87 (0.33-2.34)	0.79	0.65 (0.18-2.34)	0.51
Products_introduced_vaginaly							
No	17 (48.6)	39 (32.5)	0.08	1		1	
Yes	18 (51.4)	81 (67.5)		1.96 (0.91-4.22)	**0.08****	1.66 (0.68-4.09)	0.27
Intercourse_during_menstruation							
No	33 (94.3)	119 (99.2)	0.13	1		1	
Yes	2 (5.7)	1 (0.8)		0.14 (0.01-1.58)	**0.11***	0.08 (0.004-1.54)	0.09
Outcome_of_the_last_pregnancy							
Pregnant	5 (14.3)	10 (8.3)	0.16	1		1	
Miscarriage	3 (8.6)	29 (24.2)		4.83 (0.97-23.98)	**0.05****	5.11 (0.78-33.42)	0.09
Never	14 (40)	29 (24.2)		1.32 (0.38-4.55)	0.66	1.51 (0.34-6.77)	0.59
Live birth	13 (37.1)	44 (36.7)		1.69 (0.49-5.84)	0.41	0.89 (0.19-4.09)	0.88
Sexual_relationships_last_6_months							
No	4 (11.4)	6 (5)	0.24	1		1	
Yes	31 (88.6)	114 (95)		0.18 (0.65-9.23)	**0.19***	2.06 (0.26-16.49)	0.49
Use _of_condoms							
No	26 (74.3)	102 (85)	0.14	1		1	
Yes	9 (25.7)	18 (15)		0.51 (0.21-1.27)	**0.15***	0.61 (0.19-1.98)	0.41
Number of lifetime sexual partners							
≤ 1	10 (28.6)	16 (13.3)	**0.03***	1		1	
>1	25 (71.4)	104 (86.7)		2.60 (1.05-6.41)	**0.04****	3.34 (1.15-9.69)	**0.03***
Protection_last_intercourse							
No	28 (80)	109 (90.8)	0.15	1		1	
Yes	6 (17.1)	10 (8.4)		0.43 (0.14-1.28)	**0.13***	0.55 (0.13-2.46)	0.44
No answer	1 (2.9)	1 (0.8)		0.25 (0.02-4.24)	0.34	0.43 (0.01-14.78)	0.64

Significant p-values are in bold character

health), and bacterial vaginosis screening results (positive or negative) is presented in Table 4.

After univariate binary logistic regression analysis, the risk of bacterial vaginosis was higher among women who achieved post-secondary educational level (OR=2.97; 95% CI [1.07-8.26]), those with a monthly income greater than 140 $ US (OR = 6.05; 95% CI [0.65-56.37]), those who introduced products into the vagina (OR = 1. 65; 95% CI [0.85-3.21]), those who had a miscarriage (OR=3.33; 95% CI [0.92-12.11]), those who used contraceptive methods (OR = 1.55; 95% CI [0.82-2.92]), those who had had more than one sexual partner in their lifetime (OR = 2.04; 95% CI [0.85-4.92]) and those who used tampons (OR = 3.12; 95% CI [1.23-7.94]).

After adjusting all potential risk factors studied to eliminate all confounding factors, no factors were associated with the occurrence of bacterial vaginosis. Using backward stepwise method, in model with: use of tampons, introduction of products in vagina and the outcome of the last pregnancy; the use of tampons appeared strongly associated to the risk of bacterial vaginosis (aOR = 2.87; 95% CI [1.11-7.39]).

See appendix (Table 9) for a complete table of the descriptive and logistic regression analysis of factors associated with bacterial vaginosis, including all associated and non-associated, significant and non-significant factors.

Risk Factors Associated with vulvovaginal candidiasis

The relationship between potential risk factors and vulvovaginal candidiasis screening results (positive or negative) is presented in Table 5.

In univariate binary regression analysis, the risk of vulvovaginal candidiasis was low in women aged 36-45 years old (OR = 0.43; 95% CI [0.16-1.11]), those using contraceptive methods (OR = 0.62; 95% CI [0.32-1.18]), those whose sexual partner had other partners (OR=0.41; 95% CI [0.14-1.20]) and those using tampons (OR=0.44; 95% CI [0.19-1.02]).

After adjusting for all potential risk factors studied to eliminate all confounding factors, the risk of vulvovaginal candidiasis was lower in women who used tampons (aOR=0.29; 95% CI [0.11-0.75]) and in women aged between 36-45 years old (aOR = 0.27; 95% CI [0.09-0.82]).

Find in the appendix (Table 10) the complete table of the descriptive and logistic regression analysis of factors associated with candidiasis, listing all associated and non-associated, significant and non-significant factors.

Risk Factors Associated with Vaginal Trichomoniasis

The relationship between socio-demographic characteristics, potential risk factors (women's reproductive health, women's sexual

Table 4. Descriptive analysis and logistic regression of risk factors associated with bacterial vaginosis

Bacterial vaginosis	**Descriptive analysis**			**Logistic regression analysis**			
	Chi-square			**Univariate**		**[a]Multivariate**	
	Negative	**Positive**	**p-value**	**OR (95% CI)**	**p-Value**	**a OR (95% CI)**	**p-Value**
Caracteristics	n (%)	n (%)					
Level of education							
No education	16 (20.3)	10 (13.2)		1			
Full Primary school	22 (27.8)	19 (25)	0.12	1.38 (0.51-3.76)	0.53		
Full Secondary school	27 (34.2)	21 (27.6)		1.24 (0.47-3.29)	0.66		
Post-Secondary education	14 (17.7)	26 (34.2)		2.97 (1.07-8.26)	**0.04****		
Monthly income (US $)							
≤ 30	23 (29.1)	19 (25)		1			
32-70	24 (30.4)	17 (22.4)	0.32	0.86 (0.36-2.05)	0.73		
72-140	13 (16.5)	12 (15.7)		1.12 (0.42-3.01)	0.83		
Don't earn money	18 (22.8)	23 (30.3)		1.55 (0.65-3.68)	0.32		
>140	1(1.2)	5 (6.6)		6.05 (0.65-56.37)	**0.11***		
Products_introduced_vaginaly							
No	33 (41.8)	23 (30.3)	0.14	1		1	
Yes	46 (58.2)	53 (69.7)		1.65 (0.85-3.21)	**0.14***	1.44 (0.72-2.84)	0.30
Outcome_of_the_last_pregnancy							
Pregnant	10 (12.7)	5 (6.6)		1		1	
Miscarriage	12 (12.2)	20 (26.3)	0.21	3.33 (0.92-12.11)	**0.07****	3.23 (0.85-12.23)	0.09
Never	25(31.6)	26 (34.2)		2.08 (0.62-6.95)	0.23	1.84 (0.53-6.39)	0.34
Live birth	32 (40.5)	25 (32.9)		1.56 (0.47-5.16)	0.46	1.39 (0.40-4.82)	0.60
Contraception							
No	45 (57)	35 (46.1)	0.17	1			
Yes	34 (43)	41 (53.9)		1.55 (0.82-2.92)	**0.18***		
Number of lifetime sexual partners							
≤1	17 (21.5)	9 (11.8)	0.11	1			
>1	62 (78.5)	67 (88.2)		2.04 (0.85-4.92)	**0.11***		
Use of tampons							
No	4 (15.4)	22 (17.1)	1.00	1		1	
Yes	22 (84.6)	54 (82.9)		3.12 (1.23-7.94)	**0.02****	2.87 (1.11-7.39)	**0.03***

Significant p-values are in bold character; a = Multivariate analysis were performed using backward stepwise method

health) and trichomoniasis screening results (positive or negative) is presented in the table 6.

The χ^2 test results revealed that there was a significant difference between women who had multiple partners and others (p=0.029).

Univariate binary logistic regression analysis revealed that the risk of trichomoniasis was lower in women with menses of 4 to 7 days (OR = 0.17; 95% CI [0.02-1.66]).

The risk was high for women who did not know the duration of their relationship with their current partner (OR = 4.00; 95% CI [0.54-29.75]) and those with multiple sexual partners (OR = 14.08; 95% CI [1.41-140.75]).

After adjusting for all potential risk factors studied to eliminate all confounding factors, the risk of vaginal trichomoniasis was higher in women with multiple sexual partners (OR = 26.21; 95% CI [1.11-617.64]).

See appendix (Table 11 and 12) for a complete table of the descriptive and logistic regression analysis of factors associated with vaginal trichomoniasis, including all associated and non-associated, significant and non-significant factors.

Risk Factors Associated with Bacterial Vaginitis

The relationship between, potential risk factors and bacterial vaginitis screening results (positive or negative) is presented in Table 7.

Descriptive analysis indicated no differences between women with bacterial vaginitis and those whose were not infected.

In univariate binary regression analysis, no factors were associated with the occurrence of bacterial vaginitis.

Discussion

The study was conducted at the hospital of Bè, a public secondary hospital of Lomé. This study has some shortcomings such as a very small number of study population; due to the fact that most of the patients coming to the laboratory have already started anti-infectious treatment. Also, in the study, we did not diagnose the other germs responsible for

Table 5. Descriptive analysis and logistic regression of risk factors associated with vulvovaginal candidiasis

Candidiasis	Descriptive analysis			Logistic regression analysis			
	Chi-square			Univariate		Multivariate	
	Negative	Positive	p-value	OR (95% CI)	p-Value	a OR (95% CI)	p-Value
Caracteristics	n (%)	n (%)					
Age brackets							
[18 - 25]	25(27.2)	22(34.9)		1		1	
[26 - 29]	17(18.5)	14(22.2)	0.32	0.93 (0.37-2.32)	0.88	0.92 (0.34-2.43)	0.87
[30 - 35]	26(28.2)	18(28.6)		0.78 (0.34-1.80)	0.57	0.60 (0.24-1.51)	0.28
[36 - 45]	24(26.1)	9(14.3)		0.42 (0.16-1.10)	**0.08****	0.27 (0.09-0.82)	**0.02***
Contraception							
No	43(46.7)	37(58.7)	0.14	1		1	
Yes	49(53.3)	26(41.3)		0.61 (0.32-1.17)	**0.14***	0.52 (0.25-1.07)	0.07
Partner_who_has_other_partners							
Don't know	21(22.8)	17(27.0)		1		1	
No	34(37.0)	28(44.4)	0.30	1.01 (0.45-2.29)	0.96	1.03 (0.43-2.43)	0.94
Yes	21(22.8)	7(11.1)		0.41 (0.14-1.19)	**0.10***	0.38 (0.12-1.20)	0.10
No answer	16(17.4)	11(17.5)		0.84 (0.31-2.30)	0.74	0.72 (0.25-2.11)	0.56
Use of tampons							
No	11(12.0)	15(23.8)	0.05	1		1	
Yes	81(88.0)	48(76.2)		0.43 (0.18-1.02)	**0.05****	0.23 (0.11-0.75)	**0.01***

Significant p-values are in bold character

Table 6. Descriptive analysis and logistic regression of risk factors associated with vaginal trichomoniasis

Vaginal Trichomoniasis	Descriptive analysis			Logistic regression analysis			
	Chi-square			Univariate		Multivariate	
	Negative	Positive	p-value	OR (95% CI)	p-Value	a OR (95% CI)	p-Value
Caracteristics	n (%)	n (%)					
Lengh of relationship							
≤10	104 (68.9	2 (50)	0.24	1		1	
Don't know	26 (17.2)	2 (50)		4.00 (0.54-29.75)	**0.18***	0.28 (0.01-5.58)	0.40
> 10	21 (13.9)			0.00-	0.99	0.00-	0.99
Average_length_menstruation							
<4 days	47 (31.1)	3 (75)		1		1	
[4 - 7] days	93 (61.6)	1 (25)	0.25	0.17 (0.02-1.66)	**0.13***	0.10 (0.01-1.57)	0.10
Irregular	10 (6.6)	0 (0)		0.00-	0.99	0.00-	0.99
>7 days	1 (0.7)	0 (0)		0.00-	1.00	0.00-	1.00
Multiple_partners							
No	122 (80.8)	1 (25)	**0.03***	1		1	
Yes	26 (17.2)	3 (75)		14.08 (1.41-140.75)	**0.02****	26.21 (1.11-617.64)	**0.04***
No answer	3 (2)	0 (0)		0.00-	0.99	0.00-	0.99

Significant p-values are in bold character

Table 7. Descriptive analysis and logistic regression of risk factors associated with bacterial vaginitis

Bacterial Vaginitis	Descriptive analysis			Logistic regression analysis			
	Chi-square			Univariate		Multivariate	
	Negative	Positive	p-value	OR (95% CI)	p-Value	a OR (95% CI)	p-Value
Caracteristics	n (%)	n (%)					
Age brackets							
[18 - 25]	47 (31.3)	0 (0)	0.31	0.00-	0.99		
[26 - 29]	29 (19.3)	2 (40)		2.21 (0.19-25.64)	0.53		
[30 - 35]	42 (28)	2 (40)		1.52 (0.13-17.56)	0.74		
[36 - 45]	32 (21.4)	1 (20)		1			
Marital situation							
Maried/in relationship	97 (64.7)	4 (100)	0.66	1			
Not maried/not in relationship	54 (35.3)	0 (0)		0.46 (0.05-4.19)	0.49		
Lengh of relationship							
≤ 10	102 (68.)	4 (0)	0.64	1			
Don't know	28 (18.7)	0 (0)		0.00-	0.99		
> 10	20 (13.3)	1 (20)		1.28 (0.14-12.01)	0.83		
Level of education							
No education	25 (16.7)	1 (20)	0.93	1			
Full Primary school	39 (26)	2 (40)		1.28 (0.11-14.89)	0.84		
Full Secondary school	47 (31.3)	1 (20)		0.53 (0.03-8.87)	0.66		
Post-Secondary education	39 (26)	1 (20)		0.64 (0.04-10.72)	0.76		
Monthlty income (US $)							
≤30	41 (27.3)	1 (20)	0.76	1			
32-70	39 (26)	2 (40)		2.10 (0.18-24.13)	0.55		
72-140	25 (16.7)	0 (0)		0.00-	0.99		
Don't earn money	39 (26)	2 (40)		2.10 (0.18-24.13)	0.55		
>140	6 (4)	0 (0)		0.00-	0.99		
Average_length_ menstruation			0.42				
<4 days	49 (32.7)	1 (20)		1			
[4 - 7] days	91 (60.7)	3 (60)		1.62 (0.16-15.95)	0.68		
Irregular	9 (6)	1 (20)		5.44 (0.31-95.21)	0.25		
>7 days	1 (0.6)	0 (0)		0.00-	1.00		
Vaginal_hygene_methods							
Water	72 (48.0)	2 (40)	1.00	1			
Water and soap	74 (49.3)	3 (60)		1.46 (0.24-8.99)	0.68		
Never	4 (2.7)	0 (0)		0.00-	0.99		
Objects_used_intimate_ cleansing			1.00				
No	26 (17.3)	1 (20)		1			
Yes	125 (82.7)	4 (80)		0.84 (0.09-7.81)	0.88		
Products_introduced_ vaginaly			0.65				
No	55 (36.7)	1 (20)		1			
Yes	95 (63.3)	4 (80)		2.32 (0.25-21.24)	0.46		
Intercourse_during_ menstruation			1.00				
No	147 (98)	5 (100)		1			
Yes	3 (2)	0 (0)		0.00-	0.99		
Nomber of pregnancies							
≤ 4	91 (60.7)	5 (100)	0.34	1			
Never	52 (34.7)	0 (0)		0.00-	0.99		
>4	7 (4.6)	0 (0)		0.00-	0.99		
Outcome_of_the_last_ pregnancy							
Pregnant	15 (9.9)	0 (0)	0.23	1			
Miscarriage	31 (20.7)	1 (20)		NA			
Never	51 (34)	0 (0)		1.00 -----	1.00		
Live birth	53 (35.3)	4 (80)		NA			

Contraception							
No	77 (51.3)	3 (60)	1.00	1			
Yes	73 (48.7)	2 (40)		0.70 (0.11-4.33)	0.70		
Tobacco							
No	147 (98)	5 (100)	1.00	1			
Yes	3 (2)	0 (0)		0.00-	0.99		
Alcohol							
No	147 (98)	5 (100)	1.00	1			
Yes	3 (2)	0 (0)		0.00-	0.99		
Sexual_relationships_ last_6_months			1.00				
No	10 (6.7)	0 (0)		1			
Yes	140 (93.3)	5 (100)		NA			
Use _of_condoms							
No	124 (82.7)	4 (80)	1.00	1			
Yes	26 (17.3)	1 (20)		1.19 (0.13-11.17)	0.88		
Number of lifetime sexual partners			1.00				
≤ 1	25 (16.7)	1 (20)		1			
>1	125 (83.3)	4 (80)		0.80 (0.09-7.46)	0.85		
Protection_last_ intercourse							
No	132 (88)	5 (100)	1.00	1			
Yes	16 (10.7)	0 (0)		0.00-	0.99		
No answer	2 (1.3)	0 (0)		0.00-	0.99		
Partener_HIV_positivity							
Don't know	89 (59.3)	2 (40)	0.41	1			
No	61 (40.7)	3 (60)		1.46 (0.07-2.82)	0.39		
Multiple_partners							
No	118 (78.7)	4 (100)	0.62	1			
Yes	29 (19.3)	0 (0)		0.00-	0.99		
No answer	3 (2)	0 (0)		0.00-	0.99		
Consensual sexual intercourse			1.00				
No	4 (2.7)	0 (0)		1			
Yes	146 (97.3)	5 (100)		NA			
Partner_who_has_other_ partners							
Don't know	36 (24)	2 (40)	0.58	1			
No	59 (39.3)	3 (60)		0.92 (0.15-5.74)	0.93		
Yes	28 (18.7)	0 (0)		0.00-	0.99		
No answer	27 (18)	0 (0)		0.00-	0.99		
Use of tampons							
No	25 (16.7)	1 (20)	1.00	1			
Yes	125 (83.3)	4 (80)		0.80 (0.09-7.46)	0.85		

sexually transmitted infections (STIs) notably *Neisseria gonorrhoeae*, *Treponema pallidum*, *Chlamydia trachomatis*, *human papilloma virus*, and *herpes simplex virus*; this is because we were confronted with the lack of adequate material and equipment as well as the lack of financial means.

The aim of this study was to determine the prevalence and risk factors associated with reproductive tract infections among sexually active women in the district hospital of Bè in Togo. In this study, we determined an overall prevalence of FRTIs of 77.42%. This result was similar to that observed in Ouagadougou (Burkina-Faso) (76.8%) out of a population of 2000 women [14] and in Dakar (Senegal) (69.6%) out of a population of 260 women [15]. Nevertheless, that prevalence was higher than that found in northern India (9.7%) among women attending tertiary care centers [16] ; and that found in Nepal (39%) among married women of reproductive age [17]. These differences observed in infections prevalences may be due to differences in the study area and the study population. In addition, according to the WHO, the prevalence of lower genital tract infections varies worldwide and is influenced by sexual behavior, the age of the population as well as other socioeconomic factors [18]. The high prevalence of infections found in African countries may reflect the fact that countries in sub-Saharan Africa are hyperendemic countries for RTIs [19], underscoring the need for special attention to this issue.

Bacterial vaginosis and vulvovaginal candidiasis were the most frequent infections in the study population, with prevalence of 50.97% and 40.65% respectively. These findings are in agreement with the study of Diadhiou, *et al.* who found that the most common vaginal infections were bacterial vaginosis (39.5%) and vaginal candidiasis (29%) in symptomatic women in Dakar (Senegal) [15]. Similarly, Torondel, *et al.* found that bacterial vaginosis was the most common infection (41%) followed by candida infection (34%) [20]. Mulu, *et al.* also found that candidiasis (8.3 %) and bacterial vaginosis (2.8 %) were the most

common vaginal infections among women of the reproductive age in Ethiopia [21].

The prevalence of vaginal trichomoniasis found in our study was 2.58%. This result is quite similar to that found by Ghobahi, *et al.* in Iran, 2.6% [22] Rather, this prevalence is lower than the estimated global prevalence of trichomoniasis (5%) [23]. It is also lower than those found in the United States of America (14.6%) among women with nine sexually transmitted diseases [24] ; in Brazil (16%) among women of reproductive age [25] ; and in Swaziland (8.4%) among women of reproductive age [26]. Vaginal trichomoniasis is the most common non-viral sexually transmitted infection (STI) worldwide, caused by *Trichomonas vaginalis*, a protozoan parasite [27]. Untreated, it can lead to serious obstetric and gynecological complications such as pelvic inflammatory disease, premature delivery, spontaneous abortions pelvic, ectopic pregnancy, infertility, chronic pelvic pain, neonatal death, blindness, or severe disability in infants, and increased risk of HIV acquisition and transmission [28,29]. Its prevalence varies considerably across geographic regions, communities, cultures and religions. Having multiple sexual partners, age, number of sexual intercourses, co-infection with other sexually transmitted diseases (STDs), menstrual cycle, and individual genital health are linked to trichomoniasis transmission [30,31].

In regards to risk factors, this study showed that women who used condoms had a lower risk of RTIs. This result is similar to that of Ginindza, *et al.* who found that not using condoms increased the risk of STIs [26]. In univariate analysis, being between 30-35 years of age was found to be a risk factor for RTIs. A study reported by Kafle, *et al.* found a significantly higher prevalence of symptoms suggestive of RTIs in women aged 30 years or older [17]. Contrary to our results, the study conducted by Oyeyemi, *et al.* found that the frequency of STIs was highest in age groups of 15-20 years [32] ; similarly, Chaudhary, *et al.* found that the prevalence of STIs was highest in the 18-25 years age group [16]. Shethwala and Mulla, in a study conducted in Gujarat, also found a high prevalence of STIs (45.3%) among women under 25 years of age. This would be because this age group is the most sexually active, which makes it behaviorally more vulnerable to acquiring STIs, as it generally has more sexual partners than older age groups [16,33]. Having had more than one sexual partner in one's lifetime has been shown to be a major risk factor for the development of RTIs in our study. Contrary to our findings, several authors did not find so ; instead, they associated FRTIs with other factors such as : young age (<25years), illiteracy or low education levels, unemployment, irregular menstrual cycle, intercourses during menstruation, partner with RTI, use of contraceptive method, pregnancy below 20 years, and home delivery [15-17].

The univariate analysis showed that the introduction of products into the vagina increased the risk of bacterial vaginosis. Our findings agree with those of Brown, *et al.* in a prospective cohort study of 150 sexually active women in USA [34] ; and those of Hassan, *et al.* in a cross-sectional study of sex workers in Kenya, which also found that bacterial vaginosis was associated with intravaginal use of petroleum jelly [35]. Indeed, the use of traditional plants for sexual pleasure and genital hygiene in many countries of the world (Congo, Ghana, Kenya, Malawi, Nigeria, South Africa, Eastern Europe and United States) showed that these plants can cause imbalances in the microbial flora leading to vaginal infections [34], such as bacterial vaginosis, which is an alteration in the balance of the normal protective bacterial flora of the female reproductive system characterized by an almost total disappearance of lactobacilli and an increase in facultative and anaerobic bacteria such as *Gardnerella vaginalis* [36].

In multivariate analysis we found using tampons is a risk factor of bacterial vaginosis. This result differ from that of Brown, *et al.* who found that the use of tampons had no effect on vaginal flora [34]. However, the use of tampons has been shown to be a protective factor against the occurrence of candidiasis ; which was quite consistent with the results of Brown, *et al.* who found that the use of tampons had no effect on vaginal flora [34]. We also found that women who used condoms were protected against the occurrence of candidiasis. This finding is consistent with those of Xianling Zeng, *et al.* who also observed that condom use was a protective factor against vulvovaginal candidiasis [37].

Finally, we found that women who had multiple sexual partners were at high risk of developing vaginal trichomoniasis. Our results agree with to those of Asmah, *et al.* who found that having multiple sexual partners was associated with the occurrence of trichomoniasis [30]. Similarly, Miller, *et al.* found that the acquisition of trichomoniasis was associated with having more than one sex partner in the prior 30 days [38]. Naidoo, *et al.* also associated trichomoniasis with a number of sexual partners during her lifetime ≥ 3 [39].

Conclusion

This study showed a high prevalence of vaginal infections in women attending the district hospital of Bè. This implies that vaginal infections remain recurrent in the female population with a very high prevalence in the south of Togo. STIs diagnosis methods were not sufficient in this study, therefore a similar study, also taking into account the diagnosis of different STIs would be appropriate to better assess the overall prevalence of STIs and the responsible germs. Nevertheless, the results of this study highlight the potential factors and behaviours that contribute to the occurrence of FRTIs and could thus contribute to the development of suitable messages for awareness campaigns against those infections.

Ethics approval and consent to participate

The study was approved by the ethical board "Comité de Bioéthique pour la Recherche en Santé (CBRS)" N°007/2017/MSPS/CAB/SG/DPML/CBRS of the ministry of health and public hygiene in Togo. Women gave their consent and certified their agreement with a signature (signed forms are available).

Author's contribution

Gnatoulma Katawa, Laura E. Layland and Manuel Ritter designed the protocol; Malik da Silva Edlom Tchadié, Adjoa H. Ameyapoh, Oukoe M. Amessoudji performed the interview and assays. Christèle Nguepou Tchopba, Essoham Ataba, Kathrin Arndts, Gnatoulma Katawa and Laura Layland analysed the data, performed statistical analysis and wrote the manuscript. The manuscript was critically reviewed and proof readed by Gnatoulma Katawa and Manuel Ritter. Achim Hoerauf, Simplice D. Karou and Yaovi Ameyapoh validated the study protocol.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests

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