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Seroprevalence and determinants of Chlamydia trachomatis infection: A cross-sectional study of sexually active and HIV-negative women in Yaoundé, Cameroon

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Abstract

Introduction: Chlamydia trachomatis is the most widespread sexually transmitted infection worldwide and constitutes a public health threat in Cameroon. It affects sexually active young people, and its risk factors include multiple sexual partners and non-use of condoms. This study aimed to assess the seroprevalence of Chlamydia trachomatis infection among HIV-negative sexually active women and to determine the risk factors for this infection among these women.

Materials and methods: A total of 151 women aged between 18 and 49 years were enrolled. Prior to sampling, the women completed a questionnaire about their baseline characteristics, intravaginal practice habits, and awareness of their HIV status. All the women underwent a rapid HIV ½ diagnostic test. Bacterial vaginosis was diagnosed using a standardized procedure outlined by Nugent. For each serum sample, ELISA was used to assess the levels of IgG and IgM anti-Chlamydia trachomatis antibodies.

Results: Individuals aged 18-25 were more exposed to Chlamydia trachomatis infection, with a prevalence of 18.54%. Single women and those with university-level education suffered more from Chlamydia trachomatis infection, with a prevalence of 27.15% and 23.84%, respectively. Among women exposed to Chlamydia trachomatis infection, 27 suffered from bacterial vaginosis, resulting in a prevalence of 17.88%. 22.51% of women engaging in intravaginal practices were infected with Chlamydia trachomatis compared to 14.56% of women who suffered from Chlamydia trachomatis and did not engage in such practices. Of the women who were unaware of their HIV/AIDS status, 25.82% were exposed to Chlamydia trachomatis, compared to 11.25% who were informed about their HIV/AIDS status and suffered from Chlamydia trachomatis.

Conclusion: Intravaginal practices were linked to C. trachomatis infection. Women who were unaware of their HIV/AIDS status were more likely to be exposed to Chlamydia trachomatis infection. Women should be educated on the care of their genital system to minimise genital infections.

Keywords: Chlamydia trachomati; Bacterial vaginosis; Intravaginal practice; HIV/AIDS status; Women.

Introduction

Chlamydia trachomatis (C. trachomatis) is the most common sexually transmitted bacterial infection worldwide [3,5]. It affects sexually active young people, and the risk factors are multiple sexual partners and the non-use of condoms. According to a previous study, low socioeconomic status, nulliparity, black race, and celibacy are additional risk factors for this illness [23]. Untreated, it is responsible for a large proportion of salpingitis, pelvic inflammatory disease, extrauterine pregnancies, and infertility [34]. The World Health Organization estimates that 92 million new cases of Chlamydia trachomatis infection occur annually [22]. The incidence of Chlamydia trachomatis infection in women increased dramatically from 79 to 467 cases per 100,000 women between 1987 and 2004 [31]. In Cameroon, a study conducted by Nandi et al. among female student volunteers reported a prevalence of 3.78% [20]. Another study of women in Bandjoun, Western Cameroon, found a prevalence of 62.25% [30]. A study by Bautista et al. reported that patients with a history of bacterial vaginosis were at high risk of Chlamydia trachomatis and gonococcal infections [4]. Other studies have also shown an association between douching and sexually transmitted infections, particularly Chlamydia trachomatis [1,27,35]. The aim of our study was to assess the seroprevalence of Chlamydia trachomatis infection in seronegative HIV-AIDS and sexually active women, and to identify the risk factors for this infection in these women.

Materials and methods

Study type: A prospective cross-sectional study from 15 October to 15 December 2023 was conducted. The study took place at the Human Biology Laboratory of the Institute of Medical Research and Medicinal Plant Studies (IMPM).

Study population and size of the study population: We enrolled 151 women aged between 18 and 49 years who visited the Human Biology Laboratory to undergo biological examinations, mainly biochemical check-ups. Our sampling method was no probabilistic and accidental. The sample size was calculated using the Lorentz formula, based on the 10% prevalence of Chlamydia trachomatis infection reported in a study by Land et al [16]. The inclusion criteria were as follows: All patients who had been sexually active for at least 6 months, HIV-AIDS-negative, consented to participate in the study, and had no complaints of pruritus or vaginal discharge. Patients were excluded from the study if they were postmenopausal, taking antibiotics within two weeks, menstruating, and/or had undergone intravaginal cleansing.

Sample collection: First, the patients were interviewed, and a form was filled in with their socio-demographic data, intravaginal habits (washing the vaginal cavity with plain water or another commercial antiseptic, cleaning the walls of the vaginal cavity by scraping with the fingers, inserting traditional herbs or ova into the vaginal cavity), and Human Immunodeficiency Virus (HIV) status. We then moved on to the sampling stage, which also took place in the Human Biology Laboratory. For the vaginal swab, we ensured that the patient had not undergone intravaginal cleansing. We cleaned the vaginal margins with Dakin's solution and then used a single-use sterile speculum and sterile cotton swab (Henson Medical, Hangman, Co, Ltd) to collect secretions from the vaginal walls, which were used to diagnose bacterial vaginosis. To detect Chlamydia trachomatis infection, 5 ml of venous blood was collected in a dry tube and the serum was collected after centrifuging the tube for 15 min at 2000 rpm.

Diagnosis of bacterial vaginosis: Vaginal smears were heat-fixed and gram-stained, and then examined by light microscopy with a x100 objective using immersion oil at the Human Biology Laboratory. The results were interpreted by a trained reader who used a standardized method for diagnosing bacterial vaginosis, as described by Nugent et al., who classified vaginal flora into three groups. Group 1: score of 0-3; normal flora, predominantly lactobacilli. Group 2: score from 4 to 6; intermediate flora with few lactobacilli associated with small quantities of other poorly differentiated bacterial morphotypes. Group 3 had a score of 7 to 10; flora suggestive of bacterial vaginosis, the lactobacilli have disappeared in favor of abundant and polymorphic anaerobic flora [24]. Small bacilli, gram-negative, or variable coccobacilli were presumed to be the Gardnerella species morphotype associated with clue cells. A sniff test was performed on the vaginal secretions using 10% potassium hydroxide. The presence of a fishy odor suggests the presence of bacterial vaginosis.

Diagnosis of Chlamydia trachomatis infection: IgG and IgM antibodies were assayed on each serum using the enzyme-linked immunosorbent assay (ELISA) method with a kit from General Biologicals Corp (#6, Innovation First Road, Scienced Based Industrial Park, HSIN CHU 30077, Taiwan, R.O.C). Manipulations were performed according to the manufacturer's recommendations. The test was considered positive for an index of >1. However, in our study, a positive result was considered to be an index greater than 2 to avoid serological scarring. The test was considered negative for an index of less than 0.9. Any patient with an index between 0.9 and 2 underwent another test three weeks later.

Ethical considerations: Ethical clearance was obtained from the Comité Ethique National de Recherche en Santé Humaine under N° 2022/03/520/CE/CNERSH/SP. Participants were informed of the objectives of the study and the confidential and non-mandatory nature of their participation in the study. Women could withdraw from the study at any time without affecting the quality of their biochemical results. The authorization to conduct the study at the Institute of Medical Research and Medicinal Plant Studies obtained from the Director General of the institute.

Statistical analysis: The data were entered into Excel 2013 (Microsoft Office 2013) and analyzed using SPSS (version 16.0; SPSS Inc., Chicago, IL, USA). Pearson's chi-square test and Fisher's exact test were used to compare the proportions. Statistical significance was set than 0.05.

Results

The majority of our study population (43.04%) were women aged between 18 and 25 years. Single- and university-educated women were the most represented, with a prevalence of 70.86% and 70.19%, respectively. 56 women in our study were exposed to Chlamydia trachomatis infection, with a prevalence

of 37.08%, and 62 women had bacterial vaginosis, with a prevalence of 41.05%. The rate of co-infection with Chlamydia trachomatis and bacterial vaginosis was 17.88% (27/151). In the general population, 59.60% of the women in the study did not know their HIV-AIDS status, and of the women who were infected with Chlamydia trachomatis, only 11.25% knew their HIV-AIDS status (Table 1).

Table 1: Socio-demographic characteristics and knowledge of HIV status of the study population.

Status of the study population		
Age (years)	**Number**	**%**
18-25	65	43.04
26-33	43	28.47
34-41	16	10.59
42-49	27	17.88
Total	**151**	**100**
Marital status		
Married	40	26.49
Single	107	70.86
Other (widow…)	4	2.64
Total	**151**	**100**
Level of education		
Primary	4	2.64
Secondary	41	27.15
University	106	70.19
Total	**151**	**100**
Knowledge of HIV status		
Know status	57	37.74
Un know statuts	92	59.60
No anser	2	1.32
Total	**151**	**100**
Knowledge of HIV status among patients infected with Chlamydia trachomatis		
Know statuts	17	11.25
Unknown statuts	39	25.82
Total	**56**	**36.83**

Table 2: Relationship between Chlamydia trachomatis infection and age, marital status, level of education, knowledge of HIV status, bacterial vaginosis and intravaginal practices.

	Chlamydia trachomatis infection: Yes (%) IgM and/or IgG positive	**Chlamydia trachomatis infection : No (%) IgM and IgG Negative**	**P value**
Age (years)			
18-25	31 (20.52)	37(24.50)	
26-33	17(11.25)	28(18.54)	X2= 6.49 P=0.09
34-41	4(2.64)	12(7.94)	
42-49	4(2.64)	18(11.92)	
Total	**56(37.08)**	**95(62.9)**	
Marital status			
Maried	15(9.93)	25(16.55)	
Single	41(27.15)	68(45.03)	X^2= 1.19 P=0.55
Other (widow.)	0(0)	2(1.32)	
Total	**56(37.08)**	**95(62.9)**	
Level of education			
Primary	1(0.66)	3(1.98)	
Secondary	19(12.58)	21(13.90)	X^2= 2.65 P=0.265
University	36(23.84)	71(47.01)	
Total	**56(37.08)**	**95(62.9)**	
HIV status			
Known	17(11.25)	40(26.49)	X^2= 2.07
Unknown	39(25.82)	55(36.42)	P=0.15
Total	**56(37.08)**	**95(62.9)**	
Bacterial vaginosis			
Yes	27(17.88)	35(23.17)	X^2= 1.88
No	29(19.20)	60(39.73)	P=0.17
Total	**56(37.08)**	**95(62.9)**	
Intravaginal practice			
Yes	34(22.51)	38(25.16)	X^2=6.06 P=0.014
No	22(14.56)	57(37.74)	
Total	**56(37.08)**	**95(62.9)**	

In our study, 18-25 year olds were more exposed to Chlamydia trachomatis infection, with a prevalence of 18.54%, followed by 26-33 year olds with a prevalence of 11.25%. Single- and university-educated women suffered more from Chlamydia trachomatis infection, with a prevalence of 27.15% and 23.84%, respectively, followed by married and secondary-educated women, with a prevalence of 9.93% and 12.58%, respectively. Of the women with Chlamydia trachomatis infection, 27 had bacterial vaginosis, with a prevalence of 17.88%, whereas 19.20% had no bacterial vaginosis. In our study, 22.51% of women who practiced intravaginal sex were infected with Chlamydia trachomatis, compared with 14.56% of women who were exposed to Chlamydia trachomatis but did not practice intravaginal sex. Of the women who did not know their HIV-AIDS status, 25.82% were exposed to Chlamydia trachomatis compared with 11.25% of women who knew their HIV-AIDS status and were infected with Chlamydia trachomatis (Table 2).

Discussion

Chlamydia trachomatis is the most widespread sexually transmitted infection worldwide and is a public health problem in Cameroon. The prevalence of Chlamydia trachomatis infection in our study population was 37.08% (56/151 women). A high prevalence of this infection (41.28%) was also found in a study of sexually active women at the MIFI-Bafoussam District Hospital in Cameroon [33]. The prevalence in our study was higher than that reported by De Barbeyrac et al. (2.64%) in a population of female students in Bordeaux [7]. This low prevalence among female students could be explained by the fact that they are better informed about the mode of transmission of the infection, given their level of education, and would be screened and treated regularly, since health care is more accessible with health coverage in developed countries. Our prevalence was lower than that reported (81.2%) in a study of women with tubal infertility [26]. Chlamydia trachomatis is often the primary cause of tubal obstruction [10,18,25]. The 18-25 age group was more exposed to Chlamydia trachomatis infection (20.52%). Numerous studies have corroborated these findings [11,12,15,20,21]. This age group was more exposed to infection because they have multiple sexual partners, do not often use condoms, and lack knowledge about sexuality and contraception, which encourages risky behaviour [25]. Finally, the anatomical and histological differences in the cervix of younger women place them at greater risk of infection with Chlamydia trachomatis, since the squamocolumnar junction of the cervix

is inverted; it is also in this junction that most cervical cancers in women develop [23]. With regard to education level, university-level women were more exposed to Chlamydia trachomatis infection (23.84%), followed by secondary-level women (12.58%). The high prevalence in our study could be explained by the fact that the study population consisted mainly of female students (106/151). A study of female students in Bordeaux, France reported a low prevalence of 2.64%. This low prevalence among female students in Bordeaux may be explained by the easy access to screening for Chlamydia trachomatis infection and easy treatment in developed countries [7]. Screening programs have been followed by a marked reduction in Chlamydia trachomatis infections in Switzerland and the United States of America [9,32]. In addition, single women in our study were at a higher risk of Chlamydia trachomatis infection (27.15%) than married women (9.93%), but the difference was not significant (p=0.55). A study conducted among women at Nkoldongo District Hospital corroborated our results and reported that marital status had no significant influence on Chlamydia trachomatis infection [21]. However, a study on the epidemiology of Chlamydia trachomatis at the Meknes Military Hospital reported that married women were more exposed to this infection, although the difference was not significant [29]. In contrast, Sama et al. reported in their study that married women were significantly exposed to Chlamydia trachomatis infection [30].

In our study, 59.60% of women did not know their HIV-AIDS status, of whom 39/151 (25.82%) did not know their HIV AIDS status and were infected with Chlamydia trachomatis, compared to 11.25% (17/151) of women who knew their HIV AIDS status and were infected with Chlamydia trachomatis. This shows that knowing one's HIV-AIDS status could protect against Chlamydia trachomatis infection, since patients who were screened for HIV-AIDS were more likely to be screened for other sexually transmitted infections and undergo treatment.

Furthermore, according to our study, patients who did not suffer from bacterial vaginosis were more exposed to C. trachomatis infection (29/151), that is, 19.20% compared with 17.88% of women exposed to bacterial vaginosis and infected with C. trachomatis, but the difference was not significant (p = 0.17). However, numerous studies have reported that bacterial vaginosis is strongly associated with Chlamydia trachomatis infection [2,4,6].

Finally, 32/151 (22.51%) women who practiced intravaginal sex were more likely to have Chlamydia trachomatis 32/151 (22.51%) compared with 14.56% (22/151) who did not practice intravaginal sex and were exposed to Chlamydia trachomatis, and the difference was significant (p=0.014). The results of numerous studies corroborate our own [13,27]. Laruche et al. and McClelland et al. in their studies reported that Chlamydia trachomatis infection is associated with douching [17,19]. This association between intravaginal practices and Chlamydia trachomatis infection could be justified by the fact that the elimination of lactobacilli, which provide an acidic pH to the vaginal cavity, thus preventing the establishment of pathogenic bacteria such as Chlamydia trachomatis, would be favoured by these practices. However, other studies have not confirmed this finding. Diclemente et al. and Jing et al. found no association between douching and sexually transmitted infections [8,14].

Limitations of the study: Our study population was small because many women were discharged to maintain intimate hygiene before sampling and did not return the next day. Because of our limited budget and technical resources, we were unable to screen for Chlamydia trachomatis using the Polymerase Chain Reaction or direct immunofluorescence techniques, which are more sensitive and direct methods of screening for Chlamydia trachomatis.

Conclusion

Young people and university-educated women are at a greater risk of Chlamydia trachomatis infection. Intravaginal practices expose women to Chlamydia trachomatis. Knowing one's HIV/AIDS status could protect against this most common bacterial sexually transmitted infection worldwide.

Declarations

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Conflict of interest: the authors declare no conflict of interest.

Contribution of authors: Ngonde Essome Marie Chantal participated in the design of the study, revision and validation of the protocol, data analysis, drafting, correction and validation of the manuscript. Ahouga Roger contributed to the validation of the protocol, the collection and analysis of data, and the correction and validation of the manuscript. Maboulou Valerie contributed to the design of the study, the validation of the protocol, and the correction and validation of the manuscript. Mbakop Calixte Didier contributed to the drafting, data collection, correction and validation of the manuscript. Yimga Wanda Grace contributed to collect data,and validation of the manuscript. Ndzi Edward contributed to analyse data and the validation of the manuscript.

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