

# Prevalence of *Trichomoniasis* and *Vulvovaginal Candidiasis* among Married Women in Duhok City, Kurdistan Region, Iraq

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## ABSTRACT

*Trichomonas vaginalis* and *Candida* spp. are the most common causes of vaginal infections among reproductive-age women. *T. vaginalis* is a sexual protozoa parasite that causes trichomoniasis. *Candida* spp. are fungal and cause infection in the female genital tract named candidiasis. Both microorganisms if not treated correctly may lead to various complications, such as abortion, premature delivery, disorders of menstrual cycle, and infertility. The current study aimed to study the frequency of infections with *T. vaginalis* and *Candida* spp., including *C. albicans*, *C. krusei*, and *C. glabrata*, among females with vaginal infection in Duhok City, Kurdistan region, Iraq. A total of 400 vaginal swabs were collected from women with vaginal infections that attended the Vin Private Laboratory (n=250) and Arveen Private Laboratory (n=150). Out of these 400 vaginal swabs samples, 24 samples were recorded positive for *T. vaginalis* by direct smear and 100 samples for candidiasis by culturing on the CHROMagar™ *Candida*. Three species of *Candida* were isolated, namely *C. albicans*, *C. krusei*, and *C. glabrata*, and their prevalence rates were obtained at 60.9%, 28.25, 7.3%, and 3.6%, respectively. Vaginal infection was commonly found in the age group of 25-35 years (49.6%), followed by the age group of 35-45 years (36.4%). Moreover, 3.2% of samples were found to have a mixed infection with trichomoniasis and candidiasis. Because these two causative agents cause numerous complications in women, it is highly recommended proper controlling measures, such as health education, personal hygiene, and treatment of infected women, be implemented to prevent or decrease vaginal infection.

**Keywords:** *Candida* spp, Reproductive-age women, *Trichomonas vaginalis*, Vaginal infection

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## 1. Introduction

Vaginal infections are frequent among women of reproductive age (1). They can result from disorders that cause the overgrowth of endogenous microbiota or from sexually transmitted microorganisms. *Candida albicans* and *Trichomonas vaginalis* are two of the more prevalent vaginal microorganisms (2, 3). *T. vaginalis* is a facultative urogenital flagellate protozoan parasite of humans transmitted sexually and causing a disease named trichomoniasis or trich (4, 5). *T. vaginalis* is the most prevalent pathogenic protozoan of women in industrialized countries and is responsible for over half of all sexually transmitted infections (2, 6). Women with trichomoniasis frequently have vaginal pH levels above 4.5. However, more than 50% of those with the infection show no symptoms (7). The main symptoms of trich in women with *T. vaginalis* infection are the experience of moderate to severe cervicitis, vulvovaginitis, urethritis, premature birth or low birth weight, cervical cancer, or more susceptibility to HIV (8, 9). *Candida*-related fungi are commensals and frequently found in colonizing human skin, the gastrointestinal tract, and the genitourinary system (10). *Candida* spp. is the second most common cause of vulvovaginitis, after bacterial vaginosis (1, 11). Three out of every four women will experience at least one incident of vulvovaginal candidiasis (VVC) in their lifetimes, and it is approximated that one out of five women has *Candida* spp. and other types of fungi in their vagina (12, 13). Vulvovaginal candidiasis is known as a condition when there are symptoms of genital irritation or inflammation as well as the presence of *Candida* spp. without the presence of other etiologies (10). Therefore, the existence of this fungus does not imply an infection. Vulvovaginal candidiasis typically causes burning, itching, and vaginal discharge that resembles curd and pruritus. *Candida* proliferates better in environments with pH levels between 3.9 and 5.0 (14, 15). Vaginal pH is typically less than 4.5 in cases of VVC (1). This study aimed to compare the prevalence of *T. vaginalis* and *Candida* spp. to confirm the coexistence of these two agents.

## 2. Materials and Methods

### 2.1 Sample Collection and Processing:

This study was conducted in Duhok City, Iraq, between August 2022 and May 2023. A total of 400 vaginal swabs were collected from married women with vaginal infections that attended the Vin Private Laboratory (n=250) and Arveen Private Laboratory (n=150), Duhok City, Iraq. Initially, the direct wet smear was prepared for all vaginal swabs and examined under the microscope for screening of *T. vaginalis*. Following that, all vaginal swabs were cultured first on the blood agar and then sub-cultured on the CHROMagar™ *Candida* for the detection of *Candida* species.

### 2.2 Statistical analysis

The collected data were analyzed in SPSS software (version 15.0).

## 3. Results

Of the 400 vaginal swabs tested, 24 (6.0%) were positive for trich, and 110 (27.5%) were positive for candidiasis in married women that attended both Vin and Arveen private laboratories. Table 1

presents the total vaginal swabs collected from women of different ages who attended the Vin and Arveen privates laboratories. Table 2 shows the prevalence of infection of both trichomoniasis and candidiasis. Based on table 2, the infection rate of these diseases dropped with increasing age as follow: infection rate with both diseases were respectively 3.5%, and 18.25% in women in the age group of 25-34, 1.75% and 6.5% in the age group of 35-44, and 0.75% and 2.75% in age groups of 45-55 years old. These results were not significant at  $P < 0.05$ . It is shown in table 3 that depending on the wet vaginal swabs and culturing, 24 of 400 vaginal swaps (6.0%) were reported positive for trichomoniasis, 100 vaginal swaps (27.0%) were positive for candidiasis, and 8 vaginal samples (2.5%) were having a mixed infection (trich and candidiasis). During the current study, three species of candida, namely *C. albicans*, *C. krusei*, *C. glabrata*, were isolated from vaginal swabs by culturing on CHROMagar™ *Candida*, with a prevalence rate of 60.9%, 7.3%, and 3.6% respectively, as shown in table 4. These results were significant at  $P < 0.05$ .

## 4. Discussion

The low prevalence of trichomoniasis in this study was similar to the results found in some cities of Iraq. In Erbil City, this rate was (1.66 %) (16) and in Al-Najaf City was (8.05%) (17). These prevalence rates were lower compared to those reported in other countries, such as Polska (62-78%) (18), New York (25%) (19), and South Korea (10.4%) (20). The lower rate of trichomoniasis in this study is attributed to Islam forbidding non-marital relationships in its laws and customs. When compared to more liberal non-Islamic nations, this may be explained by the lower prevalence of this sexually transmitted protozoan infection in Islamic nations. According to reports (21, 22), sexually active women have a greater infection rate, and having multiple partners as well as lifestyle contribute to an increase in transmission.

**Table 1:** Total vaginal swabs were collected from women according to the age that attended the Vin and Arveen Privates Laboratories

Age group	Total vaginal swaps were examined	Percentage %
25-35	204	51.0
35-45	141	35.25
45-55	55	13.75
<b>Total</b>	400	100

The chi-square statistic is 0.005. The  $p$ -value is .997481. The result is not significant at  $p < 0.05$

**Table 2:** The prevalence of Trich and Candidiasis according to the age groups

Age group	Total vaginal swabs	Positive for <i>T. vaginalis</i>	Positive for <i>Candida spp.</i>
25-34	204	14 (3.5%)	73 (18.25%)
35-44	141	7 (1.75%)	26(6.5%)
45-55	55	3(0.75%)	11(2.75)
<b>Total</b>	400	24(6.0%)	110 (27.5)

The chi-square statistic is 8.4086. The *p*-value is .077708. The result is *not* significant at *p* < 0.05

**Table 3:** Types of infection were identified from vaginal swabs

Type of Infection	No. of Positive	Percentage (%)
Trichomoniasis	24	6.0
Candidiasis	110	27.0
Mixed Infection (Trich with Candidiasis)	8	2.0

The chi-square statistic is 0.0017. The *p*-value is .999168. The result is *not* significant at *p* < 0.05.

**Table 4:** Species and percentage of *Candida* were identified in the present study

<i>Candida</i> species	Positive cases
<i>C. albicans</i>	67(60.9%)
<i>C. krusei</i>	8(7.3%)
<i>C. glabrata</i>	4(3.6%)
<b>Total</b>	110

The chi-square statistic is 67.8744. The *p*-value is < 0.00001. The result is significant at *p* < 0.05

In the current study, the prevalence rate of trichomoniasis and candidiasis decreased with increasing age. Accordingly, infection rates with both diseases were higher in women in the age group of 25-34 years old, followed by age groups of 35-44 and 45-55 years old. These results were not significant at *P* < 0.05. These findings were in agreement with those of a study conducted in Baghdad City, Iraq, by Al-Muathenand and Sachit (2016) (23) among non-pregnant and pregnant women. They recorded the highest prevalence rate of both diseases in younger age groups. Furthermore, the decline in the prevalence rate of this disease with aging in the present study was consistent with the results of research carried out by Nourian et al. in Zanjan, Iran, among pregnant women (24). These results may be due to a rise in hormonal and immunologic changes, which together can heighten the susceptibility of vaginal tissue to these infections (25). Additionally, this increase might be partially caused by a low vaginal pH, which is ideal for fungus growth (26, 27). In the current study, although trichomoniasis and candidiasis were more prevalent in the age group of 25-34 years old, there was a modest rise in the number of elderly women who were infected compared to women who were under 40 years old. This finding was in agreement with the results of a study performed by Ali (2012) (24) on menopausal women; however, they were not significant at *P* > 0.05. The increase among younger women may be attributed to the higher sexual activity rates in this age group (28). These results were inconsistent with our results demonstrating that the most common species of *Candida* that caused vulvovaginitis in women was *C. albicans* (60.9%), ranking first, followed by *C. krusei* (7.3%) and *C. glabrata* (3.6%). Recently, in Al-Diwaniyah City, Iraq, Al-Sudani and Al-Awsi (2022) recorded the prevalence rates of species *C. albicans* (47.46%), *C. glabrata* (27.12%), *C. tropicalis* (15.25%), and *C. krusei* (10.17%) among women (28- 29-30); these results were

relatively similar to the current study results. Finally, mixed infections (*T. vaginalis* and *Candida*) were reported among women. It can be concluded that the age group of 25-35 years old is more susceptible to trichomoniasis and candidiasis than the other age groups. It was also found that the most frequent species of *Candida* were *C. albicans*, *C. krusei*, and *C. glabrata*, with *C. albicans* as the most common cause of vulvovaginal candidiasis.

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**Authors' Contribution**

Study concept and design: Shameeran Salman  
 Acquisition of data: Shameeran Salman  
 Analysis and interpretation of data: Shameeran Salman  
 Drafting of the manuscript: Shameeran Salman  
 Critical revision of the manuscript for important intellectual content: Shameeran Salman  
 Statistical analysis: : Shameeran Salman  
 Administrative, technical, and material support: Shameeran Salman

**Ethics**

The author declare all ethical standards have been respected in preparation of the submitted article.

**Conflict of Interest**

The author declares that there is no conflict of interest.

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