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Prevalence and Risk Factors for *Trichomonas vaginalis* Infection among Pregnant Women Seeking Primary Health Care in Sana'a City, Yemen

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ABSTRACT

Objective: To determine the prevalence and risk factors for *Trichomonas vaginalis* infection among pregnant women seeking health care in Sana'a city.

Methods: This cross-sectional study was conducted among pregnant women seeking health care in private clinics and governmental primary health care centers in Sana'a during the period from October 2014 to June 2015. Data on sociodemographic and clinical characteristics as well as possible risk factors of *T. vaginalis* infection were collected from 287 pregnant women using a pre-designed questionnaire by trained researchers. Vaginal discharges were then collected and examined microscopically for motile *T. vaginalis* trophozoites.

Results: The overall prevalence of *T. vaginalis* infection was 11.1%, with a higher infection rate among pregnant women aged 26-40 years old, housewives and rural residents. Age, literacy status and the age at first sexual intercourse were significantly associated with *T. vaginalis* infection among pregnant women. Presence of vaginal discharge (OR = 8.33; 95% CI: 2.47–28.03, P <0.001), itching (OR = 2.57; 95% CI: 1.02–6.48, P = 0.027) and presence of unpleasant odor (OR = 4.37; 95% CI: 1.63–11.70, P = 0.001) were the clinical manifestations significantly associated with *T. vaginalis* among pregnant women.

Conclusions: *T. vaginalis* is prevalent among pregnant women seeking health care in Sana'a, particularly housewives, illiterate women and those coming from rural areas. Presence of vaginal discharge with unpleasant odor and itching are associated with a higher risk of infection among symptomatic women. Further large-scale studies are required to determine the prevalence and risk factors among women of the reproductive age in Yemen.

Keywords: *Trichomonas vaginalis*, Risk factor, Pregnancy, Health care, Vaginal discharge, Yemen

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1. Introduction

Sexually transmitted diseases (STDs) pose a major public health problem in both developed and developing countries. Trichomoniasis, which is caused by the protozoan parasite *Trichomonas vaginalis*, is one of the most common non-viral STDs in the world (1, 2). In 2008, 276.4 million cases infected with STDs were reported in the world, with about 90.0% of infected cases having occurred among people living in resource-limited settings (3). *T. vaginalis* infects the lower genital tract of females as well as urethra and prostate of males. The common way of infection is the direct transmission from person to person through sexual contact, but the infection can occur through toilet seats, moist towels, contaminated douche nozzles, specula or swimming pool water (4, 5).

Trichomoniasis may be asymptomatic and, therefore, infected individuals do not know that they are harboring the parasite. In fact, most males and about half of infected females infected with the parasite show no symptoms themselves but can transmit it to others. Asymptomatic trichomoniasis is usually characterized by vaginitis, urethritis, vaginal discharge, vulvar itching, irritation, premature birth and delivery of low-birth-weight infants, postpartum endometritis, stillbirth and death (6). It may also increase the acquisition and transmission risk of human immunodeficiency virus (HIV) and herpes simplex virus type 2 infections (1, 2, 7–9).

Trichomoniasis can be difficult to diagnose because infected individuals, particularly males, are usually asymptomatic or mildly symptomatic carriers (10). Generally, examination of wet mounts of discharges and their cultivation are the most widely used methods for the diagnosis of *T. vaginalis* (11, 12).

Trichomoniasis is one of the most neglected diseases in Yemen, where there is the knowledge of the population about its transmission, prevention and control is still poor. In addition, there is a lack of the estimates of the infection rate and its possible risk factors. It is noteworthy that Yemen is one of lowest-income and least-developed countries in the world. Besides the neglect of preventable infectious diseases, the country has been placed in the bottom of human development category according to the latest Human Development Report issued in 2015 (3). Moreover, the World Bank ranks Yemen as one of the poorest countries, where about two-thirds of Yemeni people live in rural areas (3). Therefore, the aim of the present study was to determine the prevalence of *T. vaginalis* infection and associated risk factors among pregnant women seeking primary health care in Sana'a city

2. Methods

2.1. Study design, population and setting

This cross-sectional study was conducted among pregnant women seeking routine health care in private clinics or governmental health care centers in Sana'a city in the period from October 2014 to June 2015. Sana'a city, the capital of Yemen, is located in the northern part of Yemen at the geographic coordinates of 15° 20' 54''N and 44° 12' 23 E. Inclusion criteria were pregnant women in any trimester, who were aged between 17 and 47 years old and referred to private obstetrics clinics or governmental primary health care centers as a result of having genitourinary tract infections.

2.2. Sample size calculation

The sample size was calculated by Epi Info™, version 7.1.3 (Centers for Disease Control and Prevention, Atlanta, USA), using the following parameters: population size of 2 million, 5.0% con-

fidence limits, 95.0% confidence level and 1.0 design effect. The frequency of outcome was considered as 20.0%. Accordingly, the minimum sample size required was 246 women. However, 287 women were included after adding a rate of 15.0% of the calculated sample size was added to overcome a possible non-response, unusable data or other limitations.

2.3. Data collection

Data on the sociodemographic and clinical characteristics as well as possible risk factors predisposing to *T. vaginalis* infection were collected using a predesigned questionnaire by trained researchers. Physicians took samples of vaginal discharges from pregnant women using sterile non-absorbent cotton swabs. Specimens were then labeled with the patient's name and identification number, date and place of collection.

2.4. Wet mount examination

Specimen wet saline mounts were immediately examined for motile *T. vaginalis* trophozoites under the 10X and 40X objectives of a light microscope by an experienced laboratory microscopist.

2.5. Statistical analysis

Data were analyzed by IBM SPSS Statistics, version 21.0 (IBM Inc., Armonk, NY, USA). Differences and associations between categorical variables were tested using Pearson's chi-square test *and* considered statistically significant at *P*-values <0.05. In addition, the odds ratios (ORs) and their corresponding 95 % confidence interval (CI) were also calculated. Multivariable analysis using a logistic regression model was also performed to identify independent predictors of *T. vaginalis* infection among pregnant women.

3. Results

3.1 Characteristics of the study population

The mean age of the patients was 29.1 ± 7.2 years (range: 17–47). The majority of participants were aged between 26 and 40 years (54.4%) followed by those aged between 17 and 25 years (39.0%). The majority of pregnant women were literate (79.1%; 227/287), housewives (71.1%; 204/287) and urban residents (79.9%; 222/278) (Table 1).

Table (1) also shows a spectrum of clinical manifestations reported by symptomatic pregnant women. Vaginal itching was the most frequent complaint reported by 64.8% (186/287) of pregnant women, whereas lower abdominal pain was the least frequently reported complaint (29.3%).

3.2. Prevalence of T. vaginalis infection among pregnant women

The overall prevalence of *T. vaginalis* infection among pregnant women was 11.1% (32/287). Table 2 shows higher infection rates among women who were aged between 26 and 40 years old (16.6%; 26/156), illiterate (21.7%; 13/60), housewives (12.3%; 25/204) and residents in rural areas (18.5%; 12/56) (Table 2).

3.3. Risk factors associated T. vaginalis among pregnant women

Regarding the sociodemographic characteristics, univariate analysis showed that age (OR = 5.14; 95% CI: 1.75–15.09, *P* = 0.001), woman literacy status (OR = 3.02; 95% CI: 1.39–6.56, *P* = 0.006), age at first sexual intercourse (OR = 2.95; 95% CI: 1.17–7.60, *P* = 0.022) were significantly associated with *T. vaginalis* infection among pregnant women, where higher infection rates were more likely among women who were between 26 and 47 years, illiterate and aged 25 years or older at

first sexual intercourse (Table 3). However, multivariable analysis identified age and literacy status of the women as independent risk factors for acquiring *T. vaginalis* infection.

Table 1. Characteristics of pregnant women seeking health care in Sana'a - Yemen (2014–2015)*

Variable	Frequency **(%)**
Age (years)	
Mean (range): 29.1 ± 7.2 (17–47)	
17-25	112 (**39.2**)
26-40	156 (**54.3**)
41-47	19 (**6.5**)
Education	
Illiterate	60 (**20.9**)
Primary	66 (**23.0**)
Secondary	116 (**40.4**)
College	45 (**15.7**)
Occupation	
Governmental job	42 (**14.6**)
Private job	41 (**14.3**)
Housewife	204 (**71.1**)
Residence**	
Urban	222 (**79.9**)
Rural	56 (**20.1**)
Presence of vaginal discharge	
Yes	166 (**57.8**)
No	121 (**42.2**)
Unpleasant odor of discharge	
Yes	168 (**58.5**)
No	119 (**41.5**)
Vaginal itching	
Yes	186 (**64.8**)
No	101 (**35.2**)
Dysuria	
Yes	167 (**58.2**)
No	120 (**41.8**)
Lower abdominal pain	
Yes	84 (**29.3**)
No	203 (**70.7**)

*, Total women included were 287; **, residence of nine cases was missing.

Table 2. Prevalence of *T. vaginalis* infection among pregnant women seeking health care in Sana'a - Yemen (2014–2015)

Variable	*N*	*n* **(%)**
Overall	287	32 (**11.1**)
Age (years)		
17–25	112	4 (**3.6**)
26–40	156	26 (**16.6**)
41–47	19	2 (**10.5**)
Education		
Illiterate	60	13 (**21.7**)
Primary	66	3 (**4.5**)
Secondary	116	14 (**12.1**)
College	45	2 (**4.4**)
Occupation		
Governmental job	42	5 (**11.9**)
Private job	41	2 (**4.9**)
Housewife	204	25 (**12.3**)
Residence		
Urban	222	20 (**0.9**)
Rural	56	12 (**18.5**)

N, number examined*; n,* number positive.

On the other hand, occupation (OR = 1.54; 95% CI: 0.64–3.72, $P = 0.224$) and family size (OR = 1.39; 95% CI: 0.66–2.96, $P = 0.249$), the type of husband's job (OR = 1.42; 95% CI: 0.65–3.12, $P = 0.250$) and seeking health care for genitourinary complaints (OR = 1.41; 95% CI: 0.64–3.15, $P = 0.257$) were not significantly associated with *T. vaginalis* infection among pregnant women. Multivariable analysis identified age group, literacy status and causing sterility as an independent risk factor for *T. vaginalis* infection among pregnant women (Table 3).

3.4. Association of clinical manifestations with T. vaginalis infection among pregnant women

Table (4) shows that presence of vaginal discharge (OR = 8.33; 95% CI: 2.47–28.03, $P < 0.001$), presence of itching (OR = 2.57; 95% CI: 1.02–6.48, $P = 0.027$) and presence of unpleasant odor (OR = 4.37; 95% CI: 1.63–11.70, $P = 0.001$) were the clinical manifestations significantly associated with *T. vaginalis* infection among pregnant women.

Table 3. Factors associated with *T. vaginalis* infection among pregnant women in Sana'a city -Yemen (2014–2015)

Variable	*N*	*n* (%)	**OR** (95% CI)	*P*-value
Age (years)				
17-25	112	4 (3.6)	Reference	
26-47	175	28 (12.5)	**5.14** (1.75–15.09)	0.001*
Literacy status				
Literate	227	19 (8.4)	Reference	
Illiterate	60	13 (21.7)	**3.02** (1.39–6.56)	0.006*
Occupation				
Official	84	7 (8.3)	Reference	
House wife	203	25 (12.3)	**1.54** (0.64–3.72)	0.224
Residence				
Urban	222	20 (0.9)	Reference	0.053
Rural	56	12 (18.5)	**2.19** (0.96–5.00)	
Family size (members)				
≤6	190	19 (10.0)	Reference	
>6	97	13 (13.4)	**1.39** (0.66–2.96)	0.249
Type of husband's job				
Gov.	110	10 (91)	Reference	
Private	177	22 (12.4)	**1.42** (0.65-3.12)	0.250
Age at first sexual intercourse				
≤25	257	25 (9.7)	Reference	0.029
>25	29	7 (24.1)	**2.95** (1.15–7.60)	
Seeking care for genitourinary complaints				
Yes	215	22 (10.2)	Reference	
No	72	10 (13.9)	**1.41** (0.64-3.15)	0.257

N, Number examined; *n*,number positive ; OR, odds ratio; CI, confidence interval; *Confirmed as independent risk factors by multivariable analysis

Table 4. Association of certain clinical manifestations with *T. vaginalis* infection among pregnant women in Sana'a city - Yemen (2014–2015)

Variable	*N*	*n* (%)	**OR** (95% CI)	*P*-value
Presence of discharge				
No	121	3 (2.5)	Reference	
Yes	166	29 (17.5)	**8.33** (2.47–28.03)	<0.001*
Dysuria				
No	120	12 (10.0)	Reference	
Yes	167	20 (12.0)	**1.22** (0.57–2.61)	0.372
Presence of itching				
No	101	6 (5.9)	Reference	
Yes	186	26 (14.0)	**2.57** (1.02–6.48)	0.027
Presence of unpleasant odor				
No	119	5 (4.2)	Reference	
Yes	168	27 (16.1)	**4.37** (1.63–11.70)	0.001*
Presence of lower abdominal pain				
No	203	20 (9.9)	Reference	
Yes	84	12 (14.3)	**1.53** (0.71–3.28)	0.188

N, number examined; *n*, number positive; OR, odds ratio; CI, confidence interval; *Statistically significant at $P < 0.05$

4. Discussion

Up to the best of our knowledge, the present study was the first to explore the prevalence and risk factors associated with *T. vaginalis* among pregnant women in Sana'a. Light microscopy reveals *T. vaginalis* prevalence of 11.1% among pregnant women attending to health care facilities in Sana'a. This finding is comparable to those recently reported from Brazil among rural women seeking primary health care (10.5%) and among female patients from gynecology departments (9.0%) (10,13). In addition, it is consistent with those reported among Tanzanian women and their male partners (10.7%) in a community-based study and among socially-marginalized Peruvian females (9.1%) (1, 14).

In the present study, infection rate was found to increase with the age, where pregnant women aged between 26 and 47 years old showed the highest infection rate. This finding agrees with those reported in previous studies from Iran (15, 16). This could be partly attributed to biologic changes in older women as one of the predisposing factors to the parasite growth or longer duration of infectiousness and resistance to treatment.

The higher proportion of *T. vaginalis* among rural than urban pregnant women (18.5% *vs.* 9.0%, respectively) is consistent with several studies from different countries, including Mozambique (17), Palestine (18), Argentina (19) and the United States (20). The variation in *T. vaginalis* prevalence rates among different societies could be attributed to a number of factors, including sexual hygiene, sociodemographic characteristics and diagnostic tests used.

Although limited by the nature of discharge examination by light microscopy that might miss light infections, the present study could be considered a preliminary one exploring the status of *T. vaginalis* infection among Yemeni pregnant women. Therefore, further large-scale communi-

ty-based studies are recommended using more advanced diagnostic procedures such as the cultivation of the parasite and its detection by molecular techniques.

5. Conclusions

The present study reveals a low prevalence of *T. vaginalis* as detected by light microscopy among Yemeni pregnant women seeking health care, which is comparable to several other developing countries. Age and literacy status of pregnant women are independent predictors of infection, with a higher risk of contracting infection among older and illiterate women. Of clinical manifestations of symptomatic infections, presence of vaginal discharge, unpleasant odor and vaginal itching are associated with the presence T*. vaginalis* infection among Yemeni pregnant women.

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Competing interests

The authors declare that they have no competing interests associated with this article.

Ethical approval

The protocol of the study was approved by the Research Ethics Committee of the Faculty of Medicine and Health Sciences, Sana'a University, Yemen. Participation of women was voluntary after explaining to them the aim of the study and obtaining their informed consent prior to data and sample collection.

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