FULafia Journal of Science & Technology
ISSN (print) 2449-0954 \ ISSN (online) 2636-4972
https://lafiascijournals.org.ng/index.php/fjst
Sponsored By TETFund TERTIARY EDUCATION TRUST FUND
Manuscript => Received: April, 2024; Accepted: July, 2024; Published: August, 2024 https://doi.org/10.62050/fjst2024.v8n2.272

MICROSCOPY AND ANTIGENIC DETECTION OF *Trichomonas vaginalis* INFECTIONS AMONG FEMALE PATIENTS ATTENDING THE GYNECOLOGY UNIT OF DALHATU ARAF SPECIALIST HOSPITAL, LAFIA

Fatima Yusuf Al-Mustapha*, Aleruchi Chuku, Bashir Sani, Abdulaziz Dardau Aliyu, Najaatu Shehu Hadi, Okposhi Usman Shuaibu and Peter Uteh Upla
Department of Microbiology, Federal University of Lafia, PMB 146, Lafia, Nasarawa State, Nigeria
*Corresponding email: fayustee1@gmail.com

ABSTRACT
Trichomoniasis is a sexually transmitted infection (STI) with a predilection for female urogenital tract and a causative agent for cervicitis, urethritis and vaginalis in women. *Trichomonas vaginalis* infection is of medical concern amongst women, which, if detected on time, can be treated. The presence and occurrence of *T. vaginalis* among female patients attending Dalhatu Araf Specialist Hospital Lafia, Nasarawa State was investigated in this study. Vaginal swab samples of 250 women were collected and examined using wet mount and Laboquick *T. vaginalis* Antigen Test kits. The overall prevalence rate of trichomoniasis was 3.2% among the studied population. The prevalence rate among age group 15-25 years was 5, 3% in age group 26-35 and 0% among the age group 36-60. Symptomatic and asymptomatic patients exhibited a prevalence rate of 3.9 and 2.06%, respectively. Others include pregnant women with 5.7%, while non-pregnant women recorded 1.8%, students with 5.7%, housewives had 2.8%, traders had 2.5 and 0% prevalence rate was seen among civil servants and farmers, respectively. Among the two diagnostic methods used; Laboquick *T. vaginalis* antigen test gave the highest prevalence rate of 3.2% compared to wet mount which showeda 1.2% prevalence rate. This demonstrates Laboquick *T. vaginalis* antigen test kit asa more sensitive and effective diagnostic method in comparison to wet mount. Findings from this study further reiterate the need for more research to enlighten the public on the health implications, control and eradication of this common infection.

Keywords: Trichomoniasis, *Trichomonas vaginalis*, Laboquick, STI, women, antigenic detection.

INTRODUCTION
Sexually Transmitted Diseases (STDs), as reported by Bolaji *et al.* (2013) and Nouraddin and Alsakee (2015), are globally a problematic major health challenge. An estimated 500 million people acquire one of the four main sexually transmitted infections each year, with trichomoniasis being the most prevalent (Bolaji *et al.* 2013; Sugathan, 2016). Trichomoniasisis caused by *Trichomonas vaginalis* which is a single-celled, anaerobic, eukaryotic, flagellated parasite that usually causes vaginitis in the urogenital area of mostly women. *T. vaginalis* has a varied shape and size, with average of and 7 – 32 µm length (Cheon *et al.*, 2013; Beyhan, 2021). Approximately, 57-180 million people are being affected with trichomoniasis across the globe, with the majority of infected people living in developing countries (Krashin *et al.*, 2010). The prevalence of trichomoniasis ranges widely from 12 to 28.5% through a variety of people, including obstetrics and clinic attendees (Swygard *et al.* 2004). Many states in Nigeria, including Lagos (Oyeyemi *et al.*, 2016), Plateau (Jombo and Opajobi, 2006), and Imo (Ulogu *et al.*, 2007) reported an increase in the prevalence rate of trichomoniasis.

Trichomoniasis is a worldwide common non-viral sexually transmitted infection (STI) (Kissinger, 2015), usually caused by a flagellated, motile parasitic protozoan called *T. vaginalis*, which has a broad-based distribution and has also been identified among all racial and socioeconomic groups (Olusola *et al.*, 2011). It is a common infection among males and femalesof sexually active groups within child-bearing age (Workowski and Berman, 2006). An estimated 276.4 million cases were reported in 2008, and approximately 90% of these infections were reported amongstindividuals living in resource-limited locations (World Health Organization (WHO) and Department of Reproductive Health and Research, 2012), especially females. Multiple sexual partners or individuals with other reported cases of sexually transmitted infectionalways have a higher prevalence rate (Kadir *et al.*, 2014). These are mostly encountered among women leading to abnormal discharges and itching around the vagina,accompanied by dysuria, vulva-vaginal irritation and lower abdominal pains (Dahab *et al.*, 2012). Commonsymptoms of this particular infection include genital itching, painful urination, a stinking greenish and yellowish vaginal discharge,painful sex or urination, swollen labia, pains around the lower abdomen, cervical erosion, painaround the genitalia, small prompthemorrhages and swollen papillae found around the cervix and vagina (Cudmore *et al.*, 2004). Due to the high burden, severity, ease of transmission and asymptomatic cases of trichomoniasis which makes it difficult to detect, this study aimed to investigate the prevalence rate of trichomoniasis among various age

groups distributed across different socio-cultural groups of female patients attending Dalhatu Araf Specialist Hospital Lafia, Nasarawa State and compare the sensitivity and accuracy of *T. vaginalis* diagnostic methods (Laboquick test kit and wet mount).

MATERIALS AND METHODS

Study area and period

This study was conducted in Lafia, Nasarawa state, which lies between latitude 8°25' 40" N to 8°34' 15" N and longitude 8°24' 25" E to 8°38' 19" E in the Guinea savannah region of North-Central Nigeria. Lafia is a large town in Nasarawa state with an estimated population of 330, 712 (National Population Commission (NPC), 2009). The study was carried out from July to November 2019.

Sample collection

Samples were collected from the gynecology unit of DalhatuAraf Specialist Hospital Lafia, Nasarawa State and transported to the laboratory for identification using both microscopy and antigen detection kit. Two hundred and fifty women who attend the gynecology unit of DASH were enrolled in this cross-sectional study, with ages ranging from 15 to 60 years.

Ethical clearance and consent

Consent was sought and obtained from all volunteers, and documented confidentially. Ethical approval was obtained from the ethics review committees of DalhatuAraf Specialist Hospital (DASH) and Federal University of Lafia.

RESULTS AND DISCUSSION

Table 1 shows the number of samples collected (250), based on month (July to November) and manifestation of clinical symptoms. 61.2% exhibited symptoms while 38.8% were asymptomatic. The general prevalence of the study was 3.2%. Table 2 shows that symptomatic participants had a higher prevalence of (3.2%) while asymptomatic patients had (2.6 %) prevalence.

Table 1: Total number of samples collected

Periods of collection (months)	Total	Symptomatic	Asymptomatic
July	50	28	22
August	50	30	20
September	50	29	21
October	50	40	10
November	50	26	24
Total	**250**	**153(61.2%)**	**97(38.8%)**

Table 2: Prevalence of *T. vaginalis* infection among symptomatic and asymptomatic patients

Periods of collection (months)	Symptomatic N=153 (%)	Asymptomatic N= 97 (%)	Total
July	0	0	0
August	1	1	2
September	2	0	2
October	1	0	1
November	2	1	3
Total	**6 (3.9%)**	**2 (2.06%)**	**8(3.2%)**

Table 3: Prevalence of *T. vaginalis* infection according to diagnostic methods

Diagnostic Method	No Examined	No positive	Sensitivity	(%
Direct wet amount	250	3	(37.5%)	1.2
Laboquick	250	8	(100%)	3.2

Table 3 compares the sensitivity rate among the two diagnostic methods used where the Laboquick *T. vaginalis* Antigen test exhibited a higher sensitivity rate of 100%. In comparison, the wet mount showed a lower sensitivity rate of 37.5%.

Laboquick antigen test kit detected 8 positive cases of trichomoniasis than wet mount which detected 3 positive cases as shown in Table 4. In Table 5, results shows that the most active age group of 15-25 exhibited a higher prevalence rate of 5%, followed by the age group of 26-35, who had a 3% prevalence rate and 0% for the age group 36-45 and 56-60, respectively.

Table 4: A table showing the comparison between the diagnostic methods used

Collection period (months)	Wet Mount	Laboquick *T. vaginalis* Antigen Test
July	0	0
August	1	2
September	0	2
October	1	1
November	1	3
Total	**3**	**8**

Table 5: Prevalence of *T. vaginalis* infection with respect to age groups

Age Group	No Examined	No Positive	Prevalence (%)
15-25	100	5	5
26-35	115	3	2.6
36-45	20	0	0
46-55	14	0	0
56-60	1	0	0
Total	**250**	**8**	**7.6**

Table 6: Prevalence of *T. vaginalis* infection according to pregnancy status

Prevalence of Pregnancy status	No Examined	No positive	Prevalence (%)
Pregnant	87	5	5.7
Non-pregnant	163	3	1.8
Total	**250**	**8**	**7.5**

Students and housewives had the highest prevalence rates of 5 and 2.8% respectively based on occupational status of trichomoniasis patients as shown in Table 7. Civil servants had no case of the infection. More cases of trichomoniasis were observed in married women (4.95%) than single women (2.08%); no case was observed on both widows and divorced women as shown in Table 8.

Table 7: Prevalence of *Trichomonas vaginalis* infection according to occupation

Occupation	No Examined	No positive	Prevalence (%)
Students	100	5	5
Traders	40	1	2.5
Civil Servants	21	0	0
Housewives	69	2	2.8
Farmers	20	0	
Total	**250**	**8**	**10.3**

Table 8: Prevalence of *T. vaginalis* infection according to marital status

Marital Status	No Examined	No Positive	Prevalence (%)
Single	96	2	2.0
Married	121	6	4.9
Widow	13	0	0
Divorced	20	0	0
Total	**250**	**8**	**6.9**

Table 9: Prevalence of *T. vaginalis* infection according to educational status

Educational Status	No Examined	No Positive	Prevalence (%)
Primary	78	1	1.2
Secondary	49	2	4.0
Tertiary	12	0	0
Non-formal	36	1	2.8
Uneducated	75	4	5.3
Total	**250**	**8**	**13.3**

Based on educational status, participants with no form of education had highest prevalence rate of trichomoniasis as shown in Table 9. Graduates or current students of tertiary institutions had no case, while those of primary and secondary schools had prevalence rates of 1.2 and 4.08%, respectively. Rural settlers had highest prevalence rate of 4% as compared to those of urban settlers (1.33%) as shown in Table 10.

Table 10: Prevalence of *T. vaginalis* infection according to settlement/location

Location	No Examined	No Toe	Prevalence (%)
Rural Area	175	7	4
Urban Area	75	1	1.3
Total	**250**	**8**	**5.3**

Table 11: Prevalence of *T. vaginalis* infection according to clinical symptoms

Symptoms	No Examined	No Positive	Prevalence (%)
Vaginal itching	23	3	13.0
Whitish vaginal discharge	41	3	7.3
Lower abdominal pain	16	0	0
Asymptomatic	170	2	1.1
Total	**250**	**8**	**21.4**

On the basis of clinical symptoms, prevalence rates of 13, 7.3 and 0% was observed for patients exhibiting vaginal itching, whitish discharge and lower abdominal pain. 2 positive cases (1.17% prevalence rate) were observed among asymptomatic patients as shown in Table 11.

Trichomoniasis pose a significant health threat to the global population, and it is very diverse in terms of the socio-cultural status of the communities, varying from country to country (Krashin *et al.,* 2010). In the present study, two diagnostic methods – direct wet mount and Laboquick *T. vaginalis* Antigen test were compared for their accuracy in detecting *T. vaginalis* infection. Direct wet mount had a lower sensitivity (37.5%) and prevalence rate of 1.2% (3/250), while Laboquick *T. vaginalis* Antigen test had higher sensitivity (100%) and prevalence rate of 3.2% (8/250). This shows the ability of the Laboquick *T. vaginalis* Antigen test to detect true positive samples, which makes it a better screening diagnostic method in comparison with direct wet mount. The prevalence rate (3.2%) of Laboquick *T. vaginalis* Antigen test detected in this study agrees with a similar study conducted in the United States by Sutton *et al.* (2007) with 3.1% prevalence, but contrasts that of Olusola *et al.* (2011) and Chinedum *et al.* (2014) who reported a 20 and 0% prevalence rate in Abeokuta (Ogun State) and Edo State, respectively. This disparity may be due to sample size, diagnostic methods used, and socioeconomic status of the study population (Chinedum *et al.*, 2014). On the other hand, the lower sensitivity of wet mount technique might be due to fewer populations of organisms present in the sample under study. This is why adaptation of more sensitive methodologies becomes paramount (Perazzi *et al.*, 2010; Bolaji *et al.,* 2013). Further, detection of *T. vaginalis* by wet mount technique requires the expertise of the microscopists, swift transport and sample processing to avoid loss of parasite motility (Perazzi *et al.*, 2010). Although, the direct wet mount is a practical, simple, rapid and relatively cheap test but its' low sensitivity renders the method as an ineffective diagnostic tool for the detection of *T. vaginalis*. In the last decades, culturing of *T. vaginalis* was considered to be the gold standard and the reference test to which results of other tests performed in the present study were compared (Mahmoud *et al.*, 2015). Noteworthy, the isolation of *T. vaginalis* depends on the diagnostic method used. A sensitive test will give an accurate positive result whereas other test methods such as wet mount may not be very sensitive, thereby showing low prevalence. However, prevalence estimates still vary widely, even when reviewing data with similar diagnostic methods, since the studied populations were not representative of the general population (Chinedum *et al.*, 2014).

On the basis of socio-cultural parameters; students, married, uneducated, rural, symptomatic patients and pregnant women had the highest prevalence of 5, 4.95, 4.5, 4, 3.9, 2.5 and 2% amongst their respective groups.

Previous works by Amadi and Nwagbo (2013), Ahmed *et al*. (2015), Ambrozio *et al*. (2016) and Frederick *et al*. (2017) reported similar observations of high prevalence of *T. vaginalis* infections in students, uneducated, symptomatic patients and pregnant women respectively. However, the findings of a higher prevalence rate amongst rural dwellers than urban dwellers in this study disagree with Amadi and Nwagbo (2013) report. Furthermore, findings from this study showed that the age group with the highest prevalence rate was the age group of 15-25 years. This age group had a prevalence of 5%. The age group 26-35 had 2.6% prevalence rate whereas others had 0% prevalence. This finding is in agreement with that of (Uneke *et al.,* 2005; Jatau *et al.,* 2007; Bafghi *et al.,* 2009) who stated that these groups of women are sexually active. This high prevalence in the age group 15-25 is similar to a study carried out by Amadi and Nwagbo (2013) who also recorded a high prevalence rate for persons in the age group 21-30. According to occupation, this study shows that students had the highest prevalence of (5%). This agrees with Amadi and Nwagbo (2013) study which also had highest prevalence in traders and students, 23.07 and 20.63%, respectively. The prevalence according to marital status shows that, married participants were more infected 6(4.95%) than single participants 2 (2.08) which does not agree with Amadi and Nwagbo (2013) that had highest prevalence in single 77 (20.53) and 35 (16.27) for married participant. This study also showed that farmers had the least prevalence of 0%, these findings doesn't agree with that of Amadi and Nwagbo (2013) which had lower prevalence rate in house wives (8.33%). Findings in this study shows that uneducated patients had prevalence of 4 (5.33%) which agrees with a similar work done in US by Ambrozio *et al*. (2016) yielding 72% for uneducated participants. This variation may be due to the fact that educated participants take personal hygiene more seriously and have a better knowledge as compared to the uneducated ones.

Participants residing in rural areas had the highest prevalence of 7 (4%) while those residing in the urban areas had a low prevalence of 1 (1.33%). This might be due to the fact that most rural health facilities pay little attention to *T. vaginalis* infection. Also, those living in the rural areas are more prone to contact the parasite than those living in the urban area. According to this study symptomatic patient were 153 (61.2%) and they had 3.9% prevalence. On the other hand, asymptomatic patients, were 97 (38.8%) and had a prevalence of (2.06%). This agrees with Bafghi *et al.* (2009) study that reported higher prevalence in symptomatic patients than in asymptomatic patients. This study, which is the first to compare *T. vaginalis* diagnostic methods and prevalence rate of *T. vaginalis* infection in Lafia, Nasarawa State showed varied prevalence rates amongst the subgroups and previous research. Population size, environmental and socio-cultural status of the studied population could be attributed to the varied rate of prevalence observed in this study. Little or no awareness and poor public health sensitization are risk factors amongst the study populace. Poor hygienic and sanitary conditions of toilets in markets, schools and hall of residences could account for high prevalence rate observed among students and traders. Sexually activeness of students and the study populace (between the age group 16-35 years) (Uneke *et al.,* 2005; Jatau *et al.,* 2007; Bafghi *et al.,* 2009) could also account for the observed prevalence in this study.The presence of *T. vaginalis* in pregnant women calls for caution as this could lead to severe (or fatal) congenital disabilities. There is also the risk of transmission from mother to neonates and attending midwives. This is worrisome in the third trimester because it could lead to increased adverse birth outcomes and vertical transmission from mother to neonate if not treated on time (Uneke *et al.,* 2005; Jatau *et al.,* 2007; Bafghi *et al.,* 2009). This finding is in agreement with that of Bafghi *et al.* (2009) who stated that these groups of women are sexually active.

CONCLUSION

The Laboquick *T. vaginalis* antigen test kits had higher sensitivity and prevalence rate in comparison with direct wet mount. Hence, Laboquick *T. vaginalis* antigen test kit is therefore recommended for accurate and quick diagnosis to enable the proper treatment of this curable sexually transmitted infection. This study reiterates the need for more sensitization to enlighten the public on the health implications, control and eradication of this common infection. Further studies should focus on innovating various sensitive and cost-effective diagnostic methods for the screening *T. vaginalis*.

REFERENCES

Akinbo, F. O., Mokobia, C. N. and Ande, A. B. A. (2017). Prevalence of trichomoniasis among pregnant women in Benin City. *Sahel Med. J.*, 20, 67. https://doi.org/10.4103/1118-8561.215037

Amadi, A. and Nwagbo, A. (2013). *Trichomonas vaginalis* infection among women in Ikwuano Abia State Nigeria. *J. Appl. Sci. Environ. Manag.*, 17. https://doi.org/10.4314/jasem.v17i3.7

Ambrozio, C. L., Nagel, A. S., Jeske, S., Braganca, G. C. M., Borsuk, S. and Villela, M. M. (2016). *Trichomonas vaginalis* prevalence and risk factors for women in southern Brazil. *Rev. Inst. Med. Trop. Sao Paulo*, 58. https://doi.org/10.1590/S1678-9946201658061

Bafghi, A. F., Aflatoonian, A., Barzegar, K., Ghafourzadeh, M. and Nabipour, S. (2009). Frequency distribution of trichomoniasis in pregnant women referred to health centers of Ardakan, Meibod and Yazd, Iran. *Jundishapur J. Microbiol*., 2, 132–139.

Beyhan, Y. E. (2021). A systematic review of *Trichomonas vaginalis* in Turkey from 2002 to 2020. *Acta T.*, 1, 105995. https://doi:10.1016/j.actatropica.2021.105995

Bolaji, S. O., Adejare, O. F., Adeyeba A. O. and Ojurongbe, O. (2013). Comparison of methods of diagnosis of trichomoniasis in pregnancy among ante natal patients in some parts of Oyo State, Nigeria. *Int. J. Pharm. Med. Bio. Sc.*, 2(3), 5-12.

Cheon, S., Kim, S. R., Song, H., Ahn, M. and Ryu, J. (2013). The dimension of *Trichomonas vaginalis* as measured by scanning electron microscope. *Korean J. Parasitol.*, 51(2), 243-245. https://10.3347/kjp.2013.51.2.243

Chinedum, O. K., Emmanuel Ifeanyi, O., Uzoma, U. G. and Ngozi, G. C. (2014). Prevalence of *Trichomonas vaginalis* among pregnant women attending hospital in Irrua Specialist Teaching Hospital in Edo State, Nigeria. *IOSR J. Dent. Med. Sci*., 13, 79–82.

Cudmore, S. L., Delgaty, K. L., Hayward-Mcclelland, S. F., Petrin, D. P. and Garber, G. E. (2004). Treatment of infections caused by Metronidazole-resistant *Trichomonas vaginalis. Clin. Microbiol. Rev.*, 17, 783–793. https://doi.org/10.1128/CMR.17.4.783-793.2004

Dahab, M. M., Koko, S. W., Osman, E. E., Hilali and H. M. A. (2012). Prevalence and transmission of *Trichomonas vaginalis* infection among women in Khartoum State, Sudan. *J. Public Heal. Epidemiol.*, 4, 34–38. https://doi.org/10.5897/JPHE10.042

Harp, D. F. and Chowdhury, I. (2011). Trichomoniasis: Evaluation to execution. *Eur. J. Obstet. Gynecol. Reprod. Biol.*, 157, 3–9. https://doi.org/10.1016/J.EJOGRB.2011.02.024

Jatau, E. D., Olonitola, O. S. and Olayinka, A. T. (2007). Prevalence of trichomonas infection among women attending antenatal clinics in Zaria, Nigeria. *Ann. Afr. Med*., 5, 178–181.

Jombo, G. and Opajobi, S. (2006). Genital trichomoniasis among women at a University Teaching Hospital: Findings from astudy on 8,443 clinical urogenital samples in Jos, North Central Nigeria. *Internet J. Parasit. Dis*., 2, 1–7.

Kadir, M., Sulyman, M., Dawood, İ. and Shams-eldin, S. (2014). *Trichomonas vaginalis* and associated microorganisms in women with vaginal discharge in Kerkuk-Iraq. *Ankara Med. J.*, 14, 91–99. https://doi.org/10.17098/AMJ.47284

Kissinger, P. (2015). *Trichomonas vaginalis*: A review of epidemiologic, clinical and treatment issues. *BMC Infect. Dis.*, 15, 1–8. https://doi.org/10.1186/S12879-015-1055-0

Krashin, J. W., Koumans, E. H., Bradshaw-Sydnor, A. C., Braxton, J. R., Secor, W. E., Sawyer, M. K. and Markowitz, L. E. (2010). *Trichomonas vaginalis* prevalence, incidence, risk factors and antibiotic-resistance in an adolescent population. *Sex. Transm. Dis.*, 37, 440–444. https://doi.org/10.1097/OLQ.0B013E3181CFCD8C

Mahmoud, A., Sherif, N. A., Abdella, R., El-Genedy, A. R., El Kateb, A. Y. and Askalani, A. N. (2015). Prevalence of *T vaginalis* infection among Egyptian women using culture and Latex agglutination: Cross-sectional study. *BMC Women's Heal*., 15(1), 1–6. https://doi.org/10.1186/S12905-015-0169-2

National Population Commission (NPC) (2009). Federal republic of Nigeria official gazette legal notice on publication of 2006 census final results Bl-42.

Nouraddin, A. S. and Alsakee, H. M. (2015). Prevalence of *T. vaginalis* infection among women in Erbil governorate, northern Iraq: An epidemiological approach. *Eur. Sci. J*, 11, 1857–7881.

Olusola, O., Taiwo, B., Dina, B., Sina-Agbaje, O., Bolaji, O. and Adeyeba, A. (2011). Prevalence of *Trichomonas vaginalis* infection among pregnant women in Abeokuta, Nigeria. *Sierra Leone J. Biomed. Res.*, 2, 82–86. https://doi.org/10.4314/sljbr.v2i2.63996

Oyeyemi, T. O., Fadipe, O. and Oyeyemi, I. T. (2016). *T. vaginalis* infection in Nigerian pregnant women and risk factors associated with sexually transmitted infections. *I. J. STD AIDS*., 27(13). 1187- 1193. https://doi:10.1177/0956462415611292

Pereira-Neves, A., Ribeiro, K. C. and Benchimol, M. (2003). Pseudocysts in trichomonads--new insights. *Protist.*, 154, 313–329. https://doi.org/10.1078/143446103322454095

Perrzzi, E. B., Menghi C. I., Coppolillo, E. F., Gatta, C., Eliseth, M. C., de Torres, R. A., Vay, C. A. and Famiglietti, A. M. R. (2010). Prevalence and comparison of diagnostic methods for *Trichomonas vaginalis* infection in pregnant women in Argentina. *Korean J. Parasitol*., 48(1), 61-65.

Sugathan, S. (2016). Prevalence of trichomoniasis in women attending a sexually transmitted disease clinic in Mumbai. *Int. J. Sci. Study*. https://doi.org/10.17354/ijss/2016/310

Sutton, M., Sternberg, M., Koumans, E. H., McQuillan, G., Berman, S. and Markowitz, L. (2007). The prevalence of *Trichomonas vaginalis* infection among reproductive-age women in the United States, 2001–2004. *Clin. Infect. Dis*., 45, 1319–1326. https://doi.org/10.1086/522532

Swygard, H., Seña, A. C. and Hobbs, M. M. (2004). Trichomoniasis: Clinical manifestations, diagnosis and management. *Sex Transm Infect.*, 80, 91–95. https://doi.org/10.1136/sti.2003.005124

Ulogu, I. O., Obiajuru, I. O. and Ekejindu, I. M. (2007). Prevalence of trichomoniasis amongst women in Nnewi, Anambra State, Nigeria. *Nig. J. Parasitol*., 28, 6–10. https://doi.org/10.4314/njpar.v28i1.37850

Uneke, C., Ugwuoru, C., Ali, E., Ali Citation Uneke, M. C. and Ali, M. (2005). *Trichomonas vaginalis* infection among pregnant women in South-Eastern Nigeria: The Public Health Significance. *Internet J. Gynecol. Obstet*. 6, 17–21.

Workowski, K. A. and Berman, S. M. (2006). Sexually Transmitted Diseases Treatment Guidelines, 2006. CDC Morb. Mortal. Wkly. Reports 55(RR11). https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5511a1.htm (Accessed 10.13.21).

World Health Organization (WHO) (2008). Department of Reproductive Health and Research, 2012. Global incidence and prevalence of selected sexually transmitted infections– Geneva.