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Research Report

PREVALENCE OF TRICHOMONIASIS IN ASYMPTOMATIC PREGNANT WOMEN POPULATION IN BANDUNG, WEST JAVA, INDONESIA

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ABSTRACT

About 81% of pregnant women with trichomoniasis are asymptomatic, while trichomoniasis in pregnant women can increase the risk of complications, include premature rupture of membranes, preterm birth, and babies with low birth weight. Trichomoniasis can also increase the risk of other sexually transmitted infections (STIs) and human immunodeficiency virus (HIV) transmission. Trichomoniasis case in pregnant women could be influenced by demographic characteristics, the sexual behavior, and also the diagnostic method used. Until now, there is no data about prevalence of trichomoniasis in pregnant women in Indonesia. The aim of this research was to determine the prevalence of trichomoniasis in pregnant women in Bandung, West Java, Indonesia. A descriptive cross-sectional study was performed in December 2016 until January 2017. The study participants were 50 pregnant women who visit antenatal care to Obstetric and Gynecology Clinic of 'Rumah Sakit Khusus Ibu dan Anak Kota Bandung', and meet the inclusion and exclusion criteria, through consecutive sampling. The study participants had a history taking, venereological examination, and Trichomonas rapid test from vaginal swabs. Trichomoniasis in this study was diagnosed based on Trichomonas rapid test, a test that uses color immunochromatographic, capillary flow, dipstick technology, and has high sensitivity and specificity in diagnosing trichomoniasis. Almost all participants in this study were low risk pregnant women to have STI based on demographic characteristics and sexual behaviour. The positive Trichomonas rapid test result was found from one of 50 study participants. In conclusion, prevalence of trichomoniasis in pregnant women in Bandung was 2%. Trichomoniasis case in low-risk pregnant women population is still found.

Keywords: *pregnant women, trichomoniasis, trichomoniasis prevalence, Trichomonas rapid test, sexually transmitted infection*

ABSTRAK

Sekitar 81% ibu hamil dengan trikomoniasis tidak memberikan gejala, sedangkan kejadian trikomoniasis pada ibu hamil dapat meningkatkan risiko timbulnya berbagai komplikasi antara lain ketuban pecah dini, persalinan prematur, dan bayi dengan berat badan lahir rendah. Trikomoniasis juga dapat meningkatkan risiko terkena infeksi menular seksual (IMS) lain dan transmisi (human immunodeficiency virus) HIV. Kejadian trikomoniasis pada ibu hamil dapat dipengaruhi oleh karakteristik demografi, perilaku seksual, dan metode diagnostik yang digunakan. Sampai saat ini belum terdapat data mengenai prevalensi trikomoniasis pada ibu hamil di Indonesia. Tujuan penelitian ini dilakukan ialah untuk mengetahui prevalensi trikomoniasis pada ibu hamil di Bandung, Jawa Barat, Indonesia. Penelitian deskriptif dengan desain potong lintang telah dilakukan pada bulan Desember 2016 hingga Januari 2017. Peserta penelitian adalah 50 ibu hamil yang melakukan kunjungan kontrol kehamilan ke Poliklinik Kebidanan dan Kandungan Rumah Sakit Khusus Ibu dan Anak Kota Bandung, memenuhi kriteria inklusi dan eksklusi, berdasarkan urutan kedatangan. Pada peserta penelitian dilakukan anamnesis, pemeriksaan venereologis, dan tes cepat Trichomonas dari apus vagina Diagnosis trikomoniasis pada penelitian ini ditegakkan menggunakan tes cepat Trichomonas, yaitu suatu tes yang menggunakan teknologi 'dipstick' berbasis imunokromatografi warna, serta memiliki sensitivitas dan spesifitas yang tinggi untuk mendiagnosis trikomoniasis. Hampir seluruh peserta penelitian merupakan ibu hamil yang berisiko rendah terkena infeksi menular seksual berdasarkan karakteristik demografi

dan perilaku seksual. Hasil tes cepat Trichomonas positif didapatkan pada satu dari 50 peserta penelitian. Kesimpulan dari penelitian ini, prevalensi trikomoniasis pada populasi ibu hamil di Bandung sebesar 2%. Masih ditemukan kasus trikomoniasis pada populasi berisiko rendah.

Kata kunci: *ibu hamil, trikomoniasis, prevalensi trikomoniasis, test cepat Trichomonas, infeksi menular seksual*

INTRODUCTION

Trichomoniasis is sexually transmitted infection (STI) caused by a parasite, *Trichomonas vaginalis* (TV).[1,2] Based on the World Health Organization (WHO) meta analysis study in 2012, it is known that trichomoniasis is the world's most common non-viral STI and one of four curable STI.[3] In addition, the Center for Disease Control and Prevention (CDC) established trichomoniasis as one of the five neglected parasitic infections that became the priority of public health programs.[4]

In women, the disease causes inflammation primarily in the vagina,[1] causing clinical abnormalities of dense, foul-smelling, yellow vaginal discharge, which may be accompanied by abdominal pain and dysuria.[2,5,6] Based on a study which conducted in 2013 at antenatal care (ANC) clinics in Iran, it is known that only 19% of pregnant women with trichomoniasis are symptomatic.[7]

In sustainable development goals (SDGs) established by the WHO in 2015, maternal health as well as the prevention of Human Immunodeficiency Virus (HIV) infection/ Acquired Immunodeficiency Syndrome (AIDS) are the main targets.[8] If not adequately treated, trichomoniasis in pregnant women could cause complications in pregnancy, such as premature rupture of membranes (premature delivery), preterm labor, and low birth weight babies (LBW).[1,9,10] Trichomoniasis may also increase the risk of other STIs and HIV transmission.[4,6,7,11-13]

Based on prevalence studies which are conducted in 2005 from commercial sex workers population in ten cities/districts of Indonesia, namely Medan, Tanjung Pinang, Palembang, West Jakarta, Semarang, Banyuwangi, Surabaya, Bitung, Jayapura, and Bandung, the prevalence of trichomoniasis were between 3-33%, with the prevalence of commercial sex workers in Bandung was 18%.[9] There has been no report of trichomoniasis prevalence in pregnant women in Indonesia.

Clinical diagnosis of trichomoniasis in women is difficult because of variation in signs and symptoms and the similarity to other STIs, it really requires laboratory testing. Laboratory tests used to diagnose trichomoniasis are microscopic examination of wet preparation, culture, rapid tests, and nucleic acid amplification tests (TAAN).[1,7,10]

Trichomonas rapid test is a point-of-care examination with an immunochromatography-based detection system using monoclonal-specific antibodies to detect TV antigen. Trichomonas rapid test results can be found within 10 to 30 minutes.[10] In a previous study in women with trichomoniasis, the sensitivity of the examination based on Trichomonas rapid test is 83%, culture 90%, and microscopic examination 56%. Based on a study which is conducted by Campbell, it is concluded that the Trichomonas rapid test has good specificity and requires fewer human resources, that is why it is recommended for screening of low prevalence patient population.[14] OSOM® Trichomonas rapid test has been recognized by the United State (US) Food and Drug Administration (FDA) since 2004.[10]

This study was therefore conducted to determine the prevalence of trichomoniasis in pregnant women in Bandung, West Java, Indonesia.

MATERIAL AND METHOD

Study Methods

The study was carried out in Rumah Sakit Khusus Ibu dan Anak (RSKIA) Bandung, West Java, Indonesia, which is the main maternity hospital in Bandung. This study was a descriptive study using cross-sectional design conducted from December 29, 2016 to January 7, 2017.

Study Participants

The study participants were pregnant women who visited for ANC in RSKIA Bandung regardless of the age of pregnancy, and willing to follow the study after being given an explanation by signing the informed consent form. The selection of the study participants was done by consecutive sampling until the samples were met. Based on the sample size formula, the study needs minimum 29 participants.

Pregnant women who has been used vaginal cleansers (vaginal douche) in the last three days, and who received metronidazole therapy in the last two weeks were excluded from the study.

Study Procedure

The study participants who had previously been examined based on RSKIA ANC procedure, then performed:

1. History and replenishment of medical records of the study.
2. Physical examination, venereological examination, and sampling of vaginal swab for Trichomonas rapid tests.

OSOM® Trichomonas rapid test uses color immunochromatographic, dipstick technology. If TV is present in the sample, it will form a complex with the primary anti-Trichomonas antibody coated on the nitrocellulose membrane. The positive result is indicated by the visible blue line along with the red control line (Figure 1).

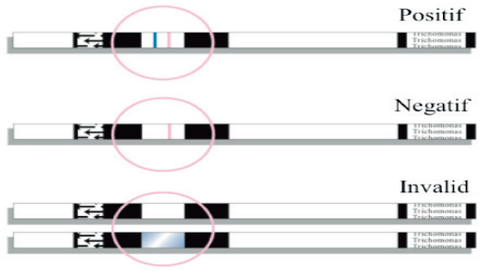

Figure 1. Trichomonas Rapid Test Dipstick: The Positive and Negative Result

Table 1. Trichomonas Rapid Test Results Based on Demographic Data of Study Participants

Variable	Total n=50	Trichomonas rapid test			
		(+)		(-)	
		Total n=1	%	Total n=49	%
Age (year old)					
>16-26	20	1	100	19	38,78
>26-45	30	0	0	30	61,22
Education					
Elementary school graduated	9	0	0	9	18,37
Junior high school graduated	13	1	100	12	24,49
Senior high school graduated	21	0	0	21	42,86
University graduated	7	0	0	7	14,29
Occupation					
Unemployee	38	1	100	37	75,51
Employee	10	0	0	10	20,41
Civil servant	1	0	0	1	2,04
Commercial sex worker	1	0	0	1	2,04
Income					
< Rp 2.600.000	20	0	0	20	40,82
Rp 2.600.000 – 4.500.000	18	0	0	18	36,73
š Rp 4.500.000	12	1	100	11	22,45
Recent gestational age					
First trimester	3	1	100	2	4,08
Second trimester	14	0	0	14	28,57
Third trimester	33	0	0	33	67,35

RESULT AND DISCUSSION

Participants of the study consisted of 50 pregnant women. Trichomonas rapid test results based on demographic data and sexual behavior characteristics of study participants are shown in table 1 and 2.

Study participant with a positive test result of Trichomonas positive was 24 years old, junior high school, unemployed (housewife), family earning above Regional Minimum Wage (RMW) of Bandung, and in first trimester of pregnancy. Based on the venereological examination, the study participant had witish yellow and thick vaginal discharge.

The youngest participant was 18 years old and the oldest was 43 years old. Almost all participants were married (98%), most were senior high school graduated (42%), unemployed (76%), had family income less than Bandung RMW (40%), and were in third trimester of pregnancy (66%).

Table 2. Trichomonas Rapid Test Results Based on Sexual Behaviour of Study Participants

Variable	Total n=50	Trichomonas rapid test			
		(+)		(-)	
		Total n=1	%	Total n=49	%
Coitarche					
< 20 year-old	18	1	100	17	34,69
š20 year-old	32	0	0	32	65,31
Sexual partner					
1 partner	43	0	0	43	87,76
>1 partners	7	1	100	7	14,29
Sexual partner					
Stable partner					
Husband	49	1	100	48	97,96
Boyfriend	1	0	0	1	2,04
Not stable partner					
Yes	1	0	0	1	2,04
No	49	0	0	49	100
Condom used					
No	45	1	100	44	89,80
Yes:					
Routine	0	0	0	0	0
Not routine	5	0	0	5	10,20
Sexual orientation					
Heterosexual	50	1	100	49	100
Bisexual	0	0	0	0	0
Lesbian	0	0	0	0	0
Narcotic, smoking, & alcohol use					
No	45	0	0	45	91,83
Alcohol	3	1	100	2	4,08
Smoking	5	1	100	4	8,16

Most (64%) of the study participants had coitarche at š20 years old. Coitarche at 15 years old was the earliest and at 30 years old was the latest. There were seven (14%) participants who had more than one sex partners in life, six of them were known to marry twice, and only one participant (who is a commercial sex worker) had multiple sexual partners.

The positive result of the Trichomonas rapid test examination of this study was obtained in one (2%) of 50 study participants. This result is similar in studies which conducted by Olowe et al.[5] in 2012 on 100 pregnant women who obtain ANC at the University of Ladoke Akintola University in Nigeria, which trichomoniasis prevalence was 2%. In that study, the diagnosis of trichomoniasis was obtained by microscopic examination of wet preparations.[5] The prevalence of trichomoniasis in pregnant women from various countries shows varying prevalence rates. The lowest prevalence has been reported for pregnant women was in South Korea in 2013, which the prevalence of trichomoniasis (based on microscopic examination of wet preparations) was 0.6%,[15] and the highest prevalence reported in the population of pregnant women in Zambia, which the prevalence of trichomoniasis (based on polymerase chain reaction/PCR) was 32.2%.[16]

The results of trichomoniasis prevalence in pregnant women in other countries are varied, ranging from 3% in South Korea in 2013 (PCR),[15] 3.3% in Iran in 2010 (microscopic and culture),[17] 7.7% in Brazil in 2009 (TAAN),[18] 8% in India in 2014 (microscopic

wet preparation),[19] 9.9% in African Republic in 1990 (culture),[20] 10.3% in Nigeria in 2013 (microscopic wet preparation),[21] to 41.4% in South Africa in 1990 (TAAN).[20] The prevalence of trichomoniasis in pregnant women is influenced primarily by demographic characteristics[22] and the participants' sexual behavior.[23] In addition, the diagnostic method used may also affect the prevalence of trichomoniasis.[13]

Some of the demographic factors significantly associated with trichomoniasis occurrence in pregnant women include active sexual age,[22,24] low levels of education,[22] as well as occupation as a prostitute.[16] High rates of trichomoniasis in the active sexual population are associated with higher sexual activity, lack awareness of STIs, as well as changes in vaginal microbiota (especially during menstrual periods).[25] In a study of pregnant women in Papua New Guinea, it was found that pregnant women aged 24 years or older had twice the risk of having trichomoniasis compared to older adults.[26]

In this study, only 40% of participants were in active sexual age population. This fact illustrated that the study population of this study was not a high risk population. Nonetheless, study participant with a positive test result of Trichomonas was a 24 years old woman. This fact showed that the result of the study was in accordance with the characteristics of pregnant women at risk of trichomoniasis.

Low levels of education are associated with a high incidence of trichomoniasis. This is due to a relation between low levels of education with unsafe sexual behavior and the number of multiple sexual partners.[26] Based on study by Allsworth et al., Romoren et al., and Miranda et al., pregnant women with education less than senior high school,[27] junior high school,[22] or only for eight years,[18] were at higher risk of TV infection.[18,22,27]

In this study, more than 50% of participants had education higher than senior high school. This fact illustrated that the study population was not a high risk population based on education level. Study participant with a positive Trichomonas rapid test result in this study was known to have junior high school education, which was consistent with the characteristics of pregnant women at risk of trichomoniasi.

Based on the results of several studies, it is known that in unemployed pregnant women were at risk of TV infection. Housewives belong to low-risk groups contracting STIs. However, transmission can be obtained by sexual partners who act as bridging populations because they are associated with commercial sexual worker/prostitute (core population).[29] Based on studies conducted by Madhivan et al.[23] in 2006 in South India, it was found that as many as 74% of women with trichomoniasis were housewives. Job that is considered to be at high risk for STIs was commercial sex worker which is associated with unsafe sexual behavior.[29] In a study performed by Crucitti et al.[16] in Zambia, it was found that commercial sex workers were more likely to be infected with TV.[16]

About 76% of this study participants were housewives. Participant with a positive test result Trichomonas positive was a housewife. There was one participant who had a job as a prostitute but no trichomoniasis was found. Further study is needed for trichomoniasis in relation with housewife work.

Trichomonas vaginalis infection can be a marker of high-risk sexual behavior.[30] Early coitarche may increase the risk of greater cumulative sexual exposure, thus increasing the risk of becoming infected with TV.[23] In a study by Madhivanan et al. [23] in 2006 in South India, two-thirds of the women who had positive trichomoniasis had coitarche when less than 19 years old.

Participants in this study were (64%) coitarche at age š19 years. This fact illustrated that the study population was largely not a risk population based on coitarche. Study participant with positive Trichomonas rapid test result had coitarche in aged 18 years. This finding was suitable with the characteristic risk of trichomoniasis.

Based on the study of Allsworth et al,[27] it was concluded that women who had 3-5 sexual partners throughout their lives had a risk of trichomoniasis nearly nine times greater. Rogers et al.[12] showed the results of his study in Baltimore in 2009 that women with trichomoniasis who had two or more previous sexual partners had a trichomoniasis risk almost three times higher than those with one sexual partner.

Most of the study participants (86%) have only one sexual partner. It also explains the low prevalence of trichomoniasis in this study. Study participant with a positive Trichomonas rapid test result in this study had a total sexual partner number of more than one person (three persons), which was fit with the characteristics of pregnant women at risk of trichomoniasis, more sexual partner–more risk of trichomoniasis.

Based on study by Miranda et al.,[18] it is known that pregnant women who have persistent sexual partners, are more at risk of being infected with TV. In this study, most of the study participants (98%) had one stable sexual partner (husband), including participant with a positive Trichomonas positive test result. The relationship between trichomoniasis and the characteristics of sexual partners needs to be further investigated.

Based on univariate analysis by Ambrozio et al.[31] in 2016 from 19 municipalities in Southern Brazil, it was found that the absence of condoms during intercourse increased the risk of being infected with TV. In a study by Swartzendruber et al.[32] of African-American women with trichomoniasis in Atlanta, it was found that there was no correlation between condom use and TV-infected risk. Most (90%) study participants never used condoms during intercourse. Participant with a positive test result of Trichomonas rapid test, was known to never use condom. Further study is needed on the use of condoms and the risk of trichomoniasis.

It was found that pregnant women who used narcotics were nearly eight times more likely to be infected with TV than those who did not.[18] Based on studies of African-

American women, it was found that smoking and alcohol consumption was associated with an increased incidence of trichomoniasis. Smoking is thought to affect the condition of the vagina to become susceptible to infection,[16] whereas alcohol consumption may increase the risk of STI infection because the effects after taking it can increase sexual desire.[30]

Most (90%) of the study participants had no history of smoking, alcohol consumption, or other drugs. This explains the participants in this study were at low risk of trichomoniasis. In this study, participant with a positive Trichomonas rapid test was known to have a history of smoking and alcohol consumption. This finding was in line with the findings of the study described before.

As known before, trichomoniasis prevalence in pregnant women is influenced by demographic characteristics,[22] the participants' sexual behavior,[23] and the diagnostic method used.[13]

In this study, almost all participants were low risk pregnant women to have trichomoniasis based on demographic characteristics and sexual behaviour. However, the study participant with a positive test result of Trichomonas rapid test was a woman with trichomoniasis risks: in active sexual age (24 years old), had low level of education (junior high school graduated), had early coitarche (at 18 years old), and had multiple sexual partners throughout her life (three partners).

The diagnostic method that used (Trichomonas rapid test) in this study was performed according to recommended procedures. This revealed that the method used in this study was probably not a factor that affects the low value of trichomoniasis prevalence.

CONFLICT OF INTEREST

We have no conflict of interest to declare.

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CONCLUSION

Trichomoniasis case in low-risk population is still found. Considering trichomoniasis complications in pregnant women (premature delivery, preterm labor, and LBW) and other STIs and HIV transmission risk after trichomoniasis infection, screening and treatment of trichomoniasis are necessarily included in ANC program.

REFERENCE

1. Hobbs MM, Sena AC, Swygard H, Schwebke JR. *Trichomonas vaginalis* and Trichomoniasis. Dalam: Holmes KK, Sparling PF, Stamm WE, Piot P, Wasserheit JN, Corey L, penyunting. Sexually transmitted disease. Edisi ke-4. New York: McGraw-Hill; 2008. h. 771-93.
2. Kissinger P. *Trichomonas vaginalis:* a review of epidemiologic, clinical and treatment issues. BMC Infect Dis. 2015;15:1-8.
3. Newman L, Rowley J, Hoorn SV, Wijesooriya NS, Unemo M, dkk. Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systematic review and global reporting. PloS ONE. 2015;10:10143304.
4. Secor WE, Meites E, Starr MC, Workowski KA. Neglected parasitic infections in the United States: Trichomoniasis. Am J Trop Med Hyg. 2014: 800-4.
5. Olowe OA, Makanjuola OB, Olowe R, Adekanle DA. Prevalence of vulvovaginal candidiasis, trichomoniasis and bacterial vaginosis among pregnant women receiving antenatal care in Southwestern Nigeria. Euro J Micro Immuno. 2014;4:193-7.
6. Donbraye E, Donbraye-Emmanuel OOB, Okonko IO, Okedeji IO, Alli JA, dkk. Detection and prevalence of *Trichomonas vaginalis* among pregnant women in Ibadan, Southwestern Nigeria. World Appl Sci J. 2010;1512-7.
7. Manshoori A, Mirzaei S, Valadkhani Z, Arababadi MK, Rezaeian M, Zainodini N, dkk. A diagnostic and symptomatological study on trichomoniasis in symptomatic pregnant women in Rafsanjan, South Central Iran in 2012-13. Iran J Parasitol. 2015;10;490-7.
8. United Nations, Department of Economic and Social Affair. Sustainable development goals. [diunduh 9 September 2016]. Tersedia dari: http://www.un.org/sustainabledevelopment/sustainable-development-goals/
9. Gerakan Nasional Penanggulangan HIV/AIDS. Prevalensii infeksi saluran reproduksi pada wanita penjaja seks di Medan, Tanjung Pinang, Palembang, Jakarta Barat, Bandung, Semarang, Banyuwangi, Surabaya, Bitung, Jayapura, Indonesia, 2005. [Diunduh 31 Maret 2016]. Tersedia dalam: http://aids-ina.org/files/publikasi/rti10kota2005.pdf.
10. Hobbs MM, Sena AC. Modern diagnosis of *Trichomonas vaginalis* infection. Sex Transm Infect. 2013;89:434-8.
11. Avidime S, Sulayman HU, Adesiyun AG. Prevalence of *Trichomonas vaginalis* and HIV co-infection among asymptomatic pregnant women in Zaria, northern Nigeria. J Health Res Rev. 2014;1: 49-53.
12. Rogers SM, Turner CF, Hobbs M, Miller WC, Tan S, dkk. Epidemiology of Undiagnosed Trichomoniasis in a Probability Sample of Urban Young Adults. PLoS ONE. 2014;9:1-10.
13. Saleh AM, Abdalla HS, Satti AB, Babiker SM, Gasim GI, dkk. Diagnosis of Trichomonous vaginalis by microscopy, latex agglutination, diamond's media, and PCR in symptomatic women, Khartoum, Sudan. Diagnostic Pathology. 2014;9:49.
14. Campbell L, Woods V, Lloyd T, Elsayed S, Church DL. Evaluation of the OSOM *Trichomonas vaginalis* vaginitis in specimens from women with a low prevalence of infection. J Clin Microbiol. 2008;46:3467-9.
15. Goo Y, Shin W, Yang H, Joo S, Song S, Ryu J, et al. Prevalence of *Trichomonas vaginalis* in women visiting 2 obstetrics and gynecology clinics in Daegu, South Korea. Korean J Parasitol. 2016;1:75-80.
16. Crucitti T, Jespers V, Mulenga C, Khondowe S, Vandepitte J, et a. *Trichomonas vaginalis* is highly prevalent in adolescent girls, pregnant women, and commercial sex workers in Ndola, Zambia. Sex Transm Dis. 2010;37: 223-7.
17. Nourian A, Shabani N, Fazaeli A, Mousavinasab SN. Prevalence of *Trichomonas vaginalis* in pregnant women in Zanjan, Northwest of Iran. Jundishapur J Microbiol. 2013;6:e7258.
18. Miranda AE, Pinto VM, Gaydos CA. *Trichomonas vaginalis* infection among young pregnant women in Brazil. Braz J Infect Dis. 2014;18:669-71.
19. Deivam S, Rajalakshmi R, Priyadharshini S, Seethalaksmi RS, Balasubramanian N, Brinda T, dkk. Prevalence of *Trichomonas vaginalis* infection among patients that presented to rural tertiary care hospital in Tiruchirapalli, India in 2011 and 2013. Int J Pharm Res Health Sci. 2013;2:255-60.
20. World Health Organization (WHO). Global prevalence and incidence of selected curable sexually transmitted infections: overviews and estimates. Geneva, Switzerland, WHO. 2001.

21. Etuketu IM, Mogaji HO, Alabi OM, Adeniran AA, Oluwole AS, Ekpo UM. Prevalence and risk factors of *Trichomonas vaginalis* infection among pregnant women receiving antenatal care in Abeokuta, Nigeria. J Infect Dis. 2015;9:51-5.
22. Romoren M, Velauthapillai M, Rahman M, Sundby J, Klouman E, dkk. Trichomoniasis and bacterial vaginosis in pregnancy: inadequately managed with the syndromic approach. Bulletin of WHO. 2007. 85:297-305.
23. Madhivanan P, Bartman MT, Pastuti L, Krupp K, Arun A, dkk. Prevalence of *Trichomonas vaginalis* infection among young reproductive age women in India: implications for treatment and prevention. Sex health. 2009;6:339-44.
24. Kementrian Kesehatan, Direktorat Jendral Pengendalian Penyakit dan Penyehatan Lingkungan. Pedoman nasional penanganan infeksi menular seksual. Jakarta: Kementrian Kesehatan. 2011.
25. Ambrozio CL, Nagel AS, Jeske S, Bragang GCM, Borsuk S, Villela MM. *Trichomonas vaginalis* prevalence and risk factors for women in Southern Brazil. Rev Inst Med Trop Sao Paulo. 2016;58:61.
26. Badman SG, Vallely LM, Toliman P, Kariwiga G, Lote B, Pomat W, dkk. A novel point-of-care testing for sexually transmitted infections among pregnant women in high-burden settings: results of a feasibility study in Papua New Gunea. BMC Infect Dis. 2016;16:1-6.
27. Allsworth JE, Ratner JA, Peipert JF. Trichomoniasis and other sexually transmitted infections: results from the 2001-2004 National Health and Nutrition Examintaion Surveys. J Sex Transm Dis. 2009;36:738-44.
28. Marconi C, Duarte TS, da Silva MG, Marcolino LD, Polettini J, Goncalves AP, dkk. *Trichomonas vaginalis* and *Chlamydia trachomatis* prevalence, incidence and associated factors in pregrant adolescents from Belem city, in the Brazilian Amazon. Open Journal of Obstetrics and Gynecology. 2015;5:677-87.
29. Centers For Disease Control and Prevention. Sexually transmitted diseases treatment guidelines. Morbidity and mortality weekly report (MMWR). Department of Health and Human Services; 2010.
30. Verscheijden MMA, Woestenberg PJ, van Bethem BHB. Sexually transmitted infections among female sex workers tested at STI clinics in Netherlands, 2006-2013. Emerg Themes Epidemiol. 2015;12:1-42.
31. Ambrozio CL, Nagel AS, Jeske S, Bragan GCM, Borsuk S, et a. *Trichomonas vaginalis* prevalence and risk factors for women in Southern Brazil. Rev Inst Med Trop Sao Paulo. 2016;58:61.
32. Swartzendruber A, Sales JM, Brown JL, Diclemente RJ, Rose ES. Correlates of incident of *Trichomonas vaginalis* infections among African American female adolescents. Sex Transm Dis. 2014;41:240-5.