Socio-demographic, Obstetric Characteristics and Molecular Confirmation of *Trichomonas vaginalis* Detected from Pregnant Women Attending Kawo General Hospital, Kaduna, Nigeria

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**Abstract**

Trichomoniasis is a widespread Sexually Transmitted Infections (STIs) that can have detrimental consequences, including infection of the skin, endometrium, Bartholin glands, and fallopian tubes and ovaries (the adnexa of the uterus). This study was conducted to assess the prevalence of *Trichomonas vaginalis* (T. vaginalis) and *T. vaginalis* from vaginal swabs of pregnant patients attending Kawo general hospital in Kaduna state. A total of 250 high vaginal swab samples were randomly taken from consenting pregnant women attending antenatal. Structured questionnaires were used to collect participant demographic and medical data. Samples were analysed by wet mount preparation and *T. vaginalis* positive samples were confirmed using Polymerase Chains Reaction (PCR). Out of the 250 pregnant women that were examined, 24 (9.6%) were positive for *T. vaginalis* infection. *T. vaginalis* was detected more in age group 20-25 (9.4%), and among women of third trimester stage (11.4%). *T. vaginalis* infection was significantly associated with age, gravidation, education and occupation. Among the 24 pregnant women that tested positive for *T. vaginalis* infection, only 2 (8.0%) were without symptoms associated with vaginal trichomoniasis, while the remaining 22 (92.0%) presented symptoms such as vaginal odour (20%), itching and discomfort (32%) and greenish yellow vaginal discharge (92%). Molecular analysis confirmed 1 positive case out of the 5 samples randomly analysed. Trichomoniasis transmission to newborn infants could be avoided with better personal cleanliness, screening, and treatment for pregnant women who are affected.

**Keywords**: Socio-demographic, Obstetric, Molecular confirmation, *Trichomonas vaginalis*, Pregnant women
INTRODUCTION

*Trichomonas vaginalis* is an extracellular single-cell flagellated protozoan parasite, causative agent of Trichomoniasis and the most prevalent and curable human pathogenic protozoan infection that can sexually be transmitted (Kim *et al*., 2016). It can also be transmitted to newborns while passing via an infected birth canal (Schwebke and Burgess, 2004). The disease is typically asymptomatic, with about one-third of asymptomatic women developing symptoms within six months of infection (Kissinger, 2015). Trichomoniasis present symptoms that includes vaginitis, vulvitis, frothy, yellow-green mucus discharge, purulent, foul-smelling vaginal discharge accompanied by itching, burning, dysuria, dyspareunia (Garber, 2005), infections of the epidermis, endometrium, Bartholin glands and ovaries (the adnexa of the uterus) are symptoms of Trichomoniasis that exposes pregnant women to the risk of other infections and complications following abortion or hysterectomy, infertility, and increased propensity for neoplastic change in cervical tissues (Chinyere *et al*., 2010). Other symptoms in women typically include vulvovaginal pain, and/or irritation, preterm membrane rupturing, premature labour, and low birth weight (Jahic *et al*., 2013). In men, prostatitis, nongonococcal urethritis, balanoposthitis, epididymitis, proctitis, and infertility (Cudmore *et al*., 2004). Lower genitourinary tract symptoms may also develop in males (Uneke *et al*., 2006).

An estimated 180 million new infections of *T. vaginalis* was reported as the most common nonviral sexually transmitted pathogen in the world (Schwebke *et al*., 2011), with available evidence indicating that *T. vaginalis* may have a significant and underappreciated role in amplifying HIV transmission and, in certain circumstances, may have a significant impact on the epidemic dynamics of HIV infection and acquired immunodeficiency syndrome (AIDS) in sub-Saharan Africa (Uneke *et al*., 2007). About 90% of infection in women were from middle-class and lower-class families, while only 10% were from upper-class families (Kaur *et al*., 2008). The frequency of vaginal Trichomoniasis has been increasing, because the rising prevalence rates in the risk factors for contracting STDs such as HIV and hepatitis B viruses, poverty, low socioeconomic status, a lack of education, high-risk sexual behaviour, incarceration (Rezaeian *et al*., 2009).

Both men and women with Trichomoniasis have been reported to frequently harbour concurrent infection with other urethral pathogens such *Neisseria gonorrhoeae* and/or *Chlamydia trachomatis*, as untreated infection can continue up to 5 years (Leon *et al*., 2009). *T. vaginalis* is extremely common and under diagnosed, resulting to increase in HIV susceptibility and transmission (Mabaso and Abbai, 2021). *Colpitis macularis*, or the "strawberry cervix," may be discovered during a colposcopic examination (Dey *et al*., 2013). Culture methods have been regarded as the most effective way to detect *T. vaginalis* but requires live organisms in comparison to molecular diagnostics that now uses nucleic acid amplification due to the limitations of culture methods and the inadequate sensitivity of sample preparation (Shipitsyna *et al*., 2012). A PCR targeting *T. vaginalis* 18S rRNA-DNA genes has enabled the detection of the organism in samples (Mayta *et al*., 2000). The infection can effectively be treated by the available drugs despite reported worries about rising levels of medication resistance (McClelland *et al*., 2007; Mavedzenge *et al*., 2010). In order to prevent re-infection, it is crucial to treat the male partners of infected women (Cudmore *et al*., 2004). With the increasing prevalence of Trichomoniasis, this study therefore aims to determine the prevalence of *T. vaginalis* and confirm the parasite from vaginal specimen of pregnant women attending Kawo general hospital using PCR.
MATERIALS AND METHODS

Study Area
The study was carried out in Kawo General Hospital located in Kawo, Kaduna North Local Government Area situated within Kaduna metropolis, Kaduna state. Kaduna north is located within latitudes 10° 35’ North and Longitudes 7° 25’ East. It is bordered by Igabi Local Government Area to the South, West, and Southeast, by Kaduna South, Chikun, Kajuru and Kauru Local Government Areas to the Northeast. It has an estimated area of 72 km² and density of 5,883.1 in h./km². With an estimated population of 423,580 as of 2006 (NPC, 2006; Nipost, 2009) Its wards are Kawo, Unguwan Kanawa/Hayin Banki, Unguwan Dosa, Badarawa/Malali, Unguwan Rimí, Unguwan Shanu/Abakpa, Doka/Gabasawa, Unguwan sarki, Unguwan gaji, Mai burji, Shaba, and Unguwan liman.

Ethical Approval
Ethical clearance was obtained from Kaduna State Ministry of Health before the commencement of this study. The purpose of the study was clearly explained to the study subjects thereby obtaining their participatory consent.

Inclusion and Exclusion Criteria
Consenting pregnant women seeking antenatal care in their current pregnancy at the Kawo General Hospital Kaduna were included while non-consenting antenatal subjects were excluded.

Sample Size Determination
Sample size was calculated according to the formula described by Naing et al. (2006), using previous prevalence of 19.2% reported by Solomon et al. (2015)

\[ n = \frac{Z^2p(1-p)}{d^2} \]

Where
n = minimum sample size
z = confidence interval at 95%
p = Prevalence in previous study (prevalence of Zaria) = 19.2% (0.192)
d = precision (acceptable margin of errors = 0.05)

Therefore, \( n = \frac{(1.96)^2 (0.192)(1-0.192)}{0.05^2} \)
\[ n = 3.8416 (0.192) (1-0.192) / 0.0025 \]
\[ n = 0.5959704576 / 0.0025 \]
\[ n = 238.38818304 \]
The sample size was approximated to 239 so as to cover up for error due to attrition.

Sample Collection
Questionnaires were administered to patients who were attending prenatal clinic for the first time during their current pregnancy in order to acquire their sociodemographic and reproductive profiles. There were two vaginal swabs taken from each individual. To prepare a moist smear, the initial swab was employed. For PCR-based parasite detection, the second swab was collected in a sterile tube with 1 mL of normal saline. According to the procedures outlined by Lawing et al. (2000), samples for PCR were treated by freezing for 4 hours. Patients who reported vaginal discharge as well as pruritus, dysuria, and dyspareunia were classified as symptomatic patients (SP). Patients who provided samples but did not express any of the aforementioned symptoms were deemed to be asymptomatic patients (ASP).
Sample Analysis
In 1 mL of normal saline, vaginal swabs were aggressively mixed before being centrifuged at 2000 g for 10 min. The pellet was re-suspended in 1 ml of sterile distilled water after the supernatant was removed, and it was then frozen at -20 °C for subsequent analysis (Inusa et al., 2018).

Wet mount microscopy
A few drops of the pellet suspended in sterile distilled water were mixed with two drops of normal saline to create a smear of the vaginal swab sample, which was then viewed using wet mount microscopy. The presence of T. vaginalis was determined through direct observation of the pear-shaped trichomonads with their distinctive jerky parasite movement, and was recognised by the characteristic oval shape, four flagella, and axostyle (Inusa et al., 2018).

Molecular analysis
DNA extraction
The swab samples that yielded positive results in wet mount microscopy were randomly selected across all age groups in order to determine the presence of T. vaginalis on such samples using PCR. Following the manufacturer's instructions, the Qiagen DNA extraction kit was used to perform the DNA extraction. All samples and reagents were brought to room temperature prior to the procedure. According to the manufacturer's instructions, 25 and 30 mL of absolute ethanol were used to make Buffer AW1 and Buffer AW2, respectively. 200 µL of vaginal swab suspension and an equivalent amount of Buffer AVL were mixed in a 1.5 mL nuclease-free microcentrifuge tube. Prior to sitting at room temperature for 10 minutes, the mixture was vortexed for 15 seconds. The tubes were centrifuged briefly to clear any drips from the interior of the lid. 400 µL of pure ethanol were added to the sample and vortexed for 15 seconds to mix together it. After mixing, tubes were gently centrifuged once more to remove any remaining drips from the lid. The solution was carefully poured into the QIAamp Mini column (in a 2 mL collection tube) without soaking the rim. The cap was fastened, and the centrifuge was spun at 8000 rpm for one minute. The flowthrough-containing tube was discarded, and the QIAamp Mini column was transferred to a clean 2 mL collecting tube. The QIAamp Mini column was carefully opened, and the remaining solution in the microtube was introduced. A 2 mL collection tube was then closed, and the flowthrough was centrifuged at 8000 rpm for one minute and discarded. The spin column was then filled with 500 µL of Buffer AW1, and the flowthrough was discarded after centrifuging at 8000 rpm for 1 minute. Additionally, 500 l of Buffer AW2 was added, centrifuged for 3 minutes at the maximum speed (14,000 rpm), and the flowthrough was discarded. Without using any reagent, the tubes were centrifuged one more for 3 minutes to spin dry. The previous collection tube containing the filtrate was removed, and a fresh 1.5 mL microcentrifuge tube was used to hold the QIAamp Mini column (Anneke et al., 2002).

Nested polymerase chain reaction
The actin gene was the target of the nesting PCR. The outer and inner primer sets, which are two sets of primers, performed with various changes (Espinosa et al., 2020).

First round of polymerase chain reaction
The initial amplification of each reaction contained the following components: 8µL of template DNA, 12.5 µL of Top Taq Master Mix, which includes MgCl2, stabilisers, enhancers, and dNTPs (dATP, dGTP, dTTP, and dCTP) in a reaction buffer. 1 litre of each primer combination, 10 pmol, and 1.5 litres of coral load (Qiagen, USA). One atL of nuclease-free water was dispensed to bring the volume to 25 µL. The Polymerase Chain Reaction was cycled in an
Applied Biosystems 9700 thermocycler using the following settings: the first stage consisted of 30 cycles, 30s of denaturation at 95 °C, 30s of annealing at 55 °C, and a 1-min extension at 72 °C (Todd, 2012).

**Second round of polymerase chain reaction**

For the second round of PCR, the identical reaction mixture with the inner primers was made, the volume was raised to 25µl using nuclease-free water, and 5µl of the amplified product from the first round was used as a template. In this step, the identical denaturation and annealing processes were performed 40 times. The last cycle was followed by a 10-minute final extension at 72 °C. After that, a 100 bp ladder and 10 µl of each amplified product were electrophoretically analysed (Biolabs, UK) (Todd, 2012).

A 1.5% agarose gel with DNA Stain was used to electrophorese each sample. The amplified product was electrophoresed in a 1.5% agarose gel using Tris-Borate EDTA buffer at 80 V. (pH 8.5). After the gel had been coloured with ethidium bromide and examined under ultraviolet light, it was documented using the Bio-Rad XRS gel documentation apparatus. Comparing the sizes of the amplified products to a commercial 100bp weight marker allowed for measurement (Valadkani et al., 2003).

**RESULTS AND DISCUSSION**

Out of 250 pregnant women examined in this study, 10 pregnant women were in their first trimester of pregnancy (1-3 months) and from these, trophozoites of *T. vaginalis* was not detected in all (0.00%). On the other hand, 123 pregnant women were in their second trimester (4-6 months) and from these trophozoite of *T. vaginalis* was detected in 14 (11.4%) pregnant women. Likewise, 117 pregnant women were in their third trimester (7-9 months) and from these *T. vaginalis* was detected in 10 (8.5%) pregnant women. From the result obtained, there is a significant difference (P<0.05) between the gravida and the number of infected cases (Table 1). This therefore means that there is a significant association between gravida and infection and gravida are dependent on the level of infection.

<table>
<thead>
<tr>
<th>Gravida</th>
<th>Number Examined</th>
<th>Number Positive (%)</th>
<th>Number Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Trimester</td>
<td>10</td>
<td>0 (0.0)</td>
<td>10</td>
</tr>
<tr>
<td>2nd Trimester</td>
<td>117</td>
<td>10 (8.5)</td>
<td>107</td>
</tr>
<tr>
<td>3rd Trimester</td>
<td>123</td>
<td>14 (11.4)</td>
<td>109</td>
</tr>
<tr>
<td>Total</td>
<td>250</td>
<td>24 (9.6)</td>
<td>226</td>
</tr>
</tbody>
</table>

Out of the 250 vaginal swabs from pregnant women attending Kawo General Hospital examined, 24 (9.6%) were positive for *T. vaginalis*. Out of the total number examined, 106 women were within the age of 20-25 years, 84 within 26-30 years, 47 within 31-35 years, 11 within 36-40 years and 2 were of age 40 years and above. *Trichomonas vaginalis* was detected in 10 (9.4%) of women within 20-25 years, 7 (8.3%) of those within 26-30 years, 5 (10.6%) within 31-35 years, and 2 (18.2%) within 36-40 years, *Trichomonas vaginalis* was not detected in age group 40 years and above 0 (0.0%). From the result obtained, there is a significant difference (P<0.05) between the ages observed and the number of infected cases (Table 2). This therefore means that there is a significant association between ages and infection and age is dependent on infection.
Table 2: Prevalence of *Trichomonas vaginalis* According to Age

<table>
<thead>
<tr>
<th>Age groups (years)</th>
<th>Number examined</th>
<th>Number positive (%)</th>
<th>Number negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 25</td>
<td>106</td>
<td>10 (9.4)</td>
<td>96</td>
</tr>
<tr>
<td>26 - 30</td>
<td>84</td>
<td>7 (8.3)</td>
<td>77</td>
</tr>
<tr>
<td>31 - 35</td>
<td>47</td>
<td>5 (10.6)</td>
<td>42</td>
</tr>
<tr>
<td>36 - 40</td>
<td>11</td>
<td>2 (18.2)</td>
<td>9</td>
</tr>
<tr>
<td>&gt; 40yrs</td>
<td>2</td>
<td>0 (0.00)</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>250</td>
<td>24 (9.6)</td>
<td>226</td>
</tr>
</tbody>
</table>

The prevalence of *Trichomonas vaginalis* based on socio-demographic and obstetric characteristics is presented in Table 3. Out of 250 pregnant women examined, based on educational status, 100 did not attend any form of formal education, from these group of pregnant women, *T. vaginalis* was detected in 13 (13.0%). On the other hand, 91 pregnant women had informal education and out of these, *T. vaginalis* was detected in 7 (7.7%) of the pregnant women. Similarly, 7 pregnant women had primary education and out of these, *T. vaginalis* was detected in 14.3%. Likewise 42 pregnant women had secondary education and out of these, *T. vaginalis* was detected in 7.2% of the pregnant women. Also 10 pregnant women had tertiary education and out of these, *T. vaginalis* was not detected in this category of pregnant women.

Based on occupation, 124 pregnant women were neither working, doing any business nor studying, hence were termed housewives, from these group of pregnant women, *T. vaginalis* was detected in 8.9% of the pregnant women. On the other hand, 7 pregnant women were civil servants and out of these, *T. vaginalis* was detected in 14.3% of the pregnant women. Similarly, 11 pregnant women were students and out of these, *T. vaginalis* was detected in 18.2%. Also, 108 pregnant women were business women and out of these, *T. vaginalis* was detected in 9.3%. Based on gravidity, 78 pregnant women were primigravida and out of these, *T. vaginalis* was detected in 9.0% of the pregnant women. Likewise, 172 pregnant women were multigravida and out of these, *T. vaginalis* was detected in 9.9%. From the results obtained, there is a significant difference (P<0.05) between the educational status and the number of infected cases.

Thus, it can be concluded that there is a noteworthy correlation between educational attainment and infection, with educational attainment being contingent upon infection level. Additionally, a noteworthy distinction exists between the number of infection and occupation. Which means that, the intensity of infection in the less educated respondents is more when compared to the educated respondents. Also, the intensity of infection among the various occupation varies accordingly. Which means that, there is a significant association between occupation and infection as the level of infection varies among the different occupations. Similarly, there is significant difference between gravidation and infection (P<0.05). Which also means that the level of infection and gravidation varies (Table 3).
Table 3: Socio-Demographic and Obstetric Characteristics of Patients with *T. vaginalis* Infection

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Number Examined</th>
<th>Number Positive (%)</th>
<th>Number Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Educational status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>100</td>
<td>13 (13.00)</td>
<td>87 (87.00)</td>
</tr>
<tr>
<td>Informal</td>
<td>91</td>
<td>7 (7.69)</td>
<td>84 (92.31)</td>
</tr>
<tr>
<td>Primary</td>
<td>7</td>
<td>1 (14.28)</td>
<td>6 (85.72)</td>
</tr>
<tr>
<td>Secondary</td>
<td>42</td>
<td>3 (7.14)</td>
<td>39 (92.86)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>10</td>
<td>0 (0.00)</td>
<td>10 (100.00)</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>124</td>
<td>11 (8.87)</td>
<td>113 (91.13)</td>
</tr>
<tr>
<td>Civil servant</td>
<td>7</td>
<td>1 (14.29)</td>
<td>6 (85.72)</td>
</tr>
<tr>
<td>Student</td>
<td>11</td>
<td>2 (18.18)</td>
<td>9 (81.82)</td>
</tr>
<tr>
<td>Business</td>
<td>108</td>
<td>10 (9.26)</td>
<td>98 (90.74)</td>
</tr>
<tr>
<td><strong>Gravidation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravida</td>
<td>78</td>
<td>7 (8.98)</td>
<td>71 (91.03)</td>
</tr>
<tr>
<td>Multigravida</td>
<td>172</td>
<td>17 (9.88)</td>
<td>155 (90.12)</td>
</tr>
</tbody>
</table>

Out of 250 pregnant women involved in this study, 6 pregnant women had yellowish discharge and out of these, trophozoites of *T. vaginalis* were detected in 1 (16.7%) of them based on wet mount preparation. Likewise 244 pregnant women had white discharge and out of these, trophozoites of *T. vaginalis* were detected in 23 (9.4%) of them based on wet mount preparation. Also none among the pregnant women had colorless discharge. From the results obtained, there is a significant difference (P<0.05) between colour of discharge observed and the number of infected cases. This therefore means that there is a significant association between colour of discharge and infection and colour of discharge are dependent on the level of infection (Table 4).

Table 4: Distribution of *T. vaginalis* in Relation to the Characteristic Appearance of Vaginal Discharge

<table>
<thead>
<tr>
<th>Colour of Discharge</th>
<th>Number Examined</th>
<th>Number Positive (%)</th>
<th>Number Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellowish colour</td>
<td>6</td>
<td>1 (16.67)</td>
<td>5 (83.33)</td>
</tr>
<tr>
<td>White colour</td>
<td>244</td>
<td>23 (9.43)</td>
<td>221 (90.57)</td>
</tr>
<tr>
<td>Colourless</td>
<td>0</td>
<td>0 (0.00)</td>
<td>0 (0.00)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>250</td>
<td>24 (9.60)</td>
<td>226 (90.40)</td>
</tr>
</tbody>
</table>

Out of 250 pregnant women involved in this study, 94 pregnant women had discharge only and from these, trophozoites of *T. vaginalis* were detected in 3 (3.20%) of them. On the other hand, 56 pregnant women had discharge and itching and out of these, trophozoites of *T. vaginalis* were detected in 4 (7.2%) of the pregnant women. Similarly, 71 pregnant women had discharge and dysuria out of which *T. vaginalis* were detected in 5 (7.1%) of the pregnant women. Also, 29 pregnant women had discharge, itching and dysuria out of which trophozoites of *T. vaginalis* were detected in 12 (41.4%) of them (Table 5). From the results obtained, there is a significant difference (P<0.05) between the clinical symptoms observed and the number of infected cases.
Socio-demographic, Obstetric Characteristics and Molecular Confirmation of Trichomonas vaginalis Detected from Pregnant Women Attending Kawo General Hospital, Kaduna, Nigeria

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Table 5: Distribution of *T. vaginalis* Infection Based on Clinical Symptoms

<table>
<thead>
<tr>
<th>Clinical Symptoms</th>
<th>Number Examined</th>
<th>Number Positive (%)</th>
<th>Number Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge only</td>
<td>94</td>
<td>3 (3.19)</td>
<td>91 (96.81)</td>
</tr>
<tr>
<td>Discharge and itching</td>
<td>56</td>
<td>4 (7.14)</td>
<td>52 (92.86)</td>
</tr>
<tr>
<td>Discharge and dysuria</td>
<td>71</td>
<td>5 (7.04)</td>
<td>66 (92.96)</td>
</tr>
<tr>
<td>Discharge, itching and dysuria</td>
<td>29</td>
<td>12 (41.37)</td>
<td>17 (58.62)</td>
</tr>
<tr>
<td>Total</td>
<td>250</td>
<td>24 (9.60)</td>
<td>226 (90.40)</td>
</tr>
</tbody>
</table>

Molecular Confirmation of Wet Mount Sample

Out of the 24 samples that were positive for *T. vaginalis* using wet microscopy, 5 samples were randomly selected and subjected to confirmation via PCR. Results show that only 1 sample was positive at band size 1100-bp as shown in plate I.

![Plate I: Electrophorogram of Amplified PCR products: Lane M molecular ladder (100 bp), lane 1 to lane 5 samples, lane 4 positive sample (1100 bp).](image)

The 9.6% prevalence of *Trichomonas vaginalis* infection in this study is quite high, indicating that nearly one in ten pregnant women are at risk of *T. vaginalis* infection. This is consistent with the prevalence of 10.99% reported by Mairiga et al. (2011), and lower than the reports according to Klebanoff et al. (2001), indicating a prevalence 7.6% in the US. Donbraye et al. (2010) also reported a lower prevalence of *Trichomonas vaginalis* infection of 6.0% in Ibadan, and Abioye et al. (2014) observed a prevalence of 7.5% in Nassarawa State.

However, the higher prevalence of *Trichomonas vaginalis* infection recorded by Uneke et al. (2007) was 24.4% in Ebonyi, Jatau et al. (2006) also reported a prevalence of 18.66 in Zaria, Kaduna State, and Damen et al. (2014) claimed a frequency of 16% in Plateau State. These variations could be explained by the different sociocultural lifestyles of the pregnant women studied and by the pregnant women's general awareness of good hygienic habits.

The significantly high prevalence of *Trichomonas vaginalis* infection seen in this study may be attributable to a decline in immunity brought on by ageing, the stress of pregnancy, illiteracy, increased demands placed on the developing foetus as well as the women's reluctance and lack of interest in practising good hygiene.

In comparison to pregnant women with educational backgrounds, more than half of *T. vaginalis*-infected women had no formal education, suggesting that formal education significantly affects the prevalence of *T. vaginalis* infection recorded in this study. This result is consistent with that of Sutton et al. (2007), who reported that women with lower literacy...
levels had a higher prevalence of *T. vaginalis* than women with higher literacy levels. However, these results diverge from those of Maufi *et al.* (2016), who reported that *T. vaginalis* infection was more common in women with higher literacy backgrounds and less common in those with lower literacy backgrounds.

In this study, the highest prevalence of 11.4% regarding *T. vaginalis* infection was discovered in pregnant women who were in their third trimester of pregnancy. This finding is consistent with those of Mairiga *et al.* (2011), who recorded a higher prevalence of *T. vaginalis* infection at 21.1% among pregnant women in their third trimester. Uneke *et al.* (2005), similarly found a higher prevalence of 8.2% in their third trimester. This high prevalence may be caused by an increase in the demands placed on the developing foetus, which may reduce the mother’s immune capacity and enable infection to flourish Damen *et al.* (2014).

**Conclusion**

There was a significant association between clinical symptoms of Trichomoniasis, gravidation, ages and infection in this study. Clinical symptoms, gravidation and ages were equally dependent on the level of infection. Diagnosis of Trichomoniasis using nucleic acid amplification is more sophisticated than microscopy and culture methods, associated with several limitations

**Conflict of Interest**

No competing interest exist

**REFERENCES**


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