

Original Research Article

TRICHOMONAS VAGINALIS AND CANDIDA ALBICANS INFECTIONS AMONG WOMEN OF REPRODUCTIVE AGE IN IHIALA, ANAMBRA STATE, NIGERIA

ABSTRACT

Co-infection of *T. vaginalis* and *C. albicans* continues to present major health, social and economic problems in Nigeria. A study on the prevalence and co-infection of *T. vaginalis* and *C. albicans* among women of reproductive age in Ihiala community, Anambra state, was conducted between January and March 2015. A total of 734 women from the four villages in Ihiala participated in the study. Wet mounts were used to examine the high vaginal swabs of the women. Jerky movement and flagella were used to confirm the presence of *T. vaginalis*. Germ- tube test was used to confirm *C. albicans* after culturing on sabouraud dextrose agar. Of the 734 women enrolled in the study, 150(20.4%) were positive to *C. albicans*, 7(1.0%) were positive to *T. vaginalis* and 4(0.5%) had co-infection of *T. vaginalis* and *C. albicans*. Women in the age group 40-49 years had the highest infection 22(37.9%) of *C. albicans* and the age group 20-29 years had the lowest 96(17.0%). Women in the age group, 30-39 years had the highest co-infection of *C. albicans* and *T. vaginalis* 2(1.8%), and the age group 20-29 years had the lowest 2(0.4%). Co-infections of the pathogens were highest 2(6.7%) among the traders and none among civil servants and students. Co-infection of the pathogens was observed in married women only and highest 1(3.6%) among wives of polygamous men. Co-infections of *T. vaginalis* and *C. albicans* was highest 1(14.3%) among the women with non-formal education and none among the women with tertiary education. Co-infections of the pathogens were observed only among non- pregnant women. Low co-infection rate of the parasites observed in this study could be attributed to improved life style, especially in personal hygiene and literacy in reproductive health, as well as the use of metronidazole in the treatment of other protozoal infections. Since most of the co-infections were observed among women with no formal education and among women in polygamous families, it is suggested that mass education on reproductive health to both men and women will help to reduce the scourge of these infections in the study area.

Keywords: *Trichomonas vaginalis*, *Candida albicans*, women, Ihiala, Anambra State.

1.0 INTRODUCTION

Trichomonas vaginalis is likely the most common non-viral sexually transmitted infection in the world. It is an important source of reproductive morbidity, a facilitator of Human Immuno-deficiency Virus (HIV) transmission and acquisition, and thus it is an important public health problem among women of reproductive age (Kissinger, 2015). The incidence of trichomoniasis depends on the population examined. Certain factors such as poor personal hygiene, multiple sex partners, low socio-economic status and underdevelopment are associated with high incidence of infection (Crosby *et al.*, 2002). *T. vaginalis* infection is also associated with the presence of other sexually transmitted infections, including gonorrhoea, chlamydia, and sexually transmitted viruses. The infection increases the susceptibility to other viruses, including herpes, human papillomavirus (HPV) and human immunodeficiency virus (HIV) (Huppert, 2009)

The disease is caused by a pear-shaped protozoan, called *T. vaginalis* (Schwebke, 2002) and characterized in female patients by frothy-greenish-foul smelling vaginal discharge accompanied with vulvo-vaginal irritation, dysuria, lower abdominal pains, discomfort and psychosocial distress (Faro, 2004; Edrisian *et al.*, 2006). These symptoms are usually aggravated during menses and pregnancy and other complications include cystitis, cervicitis and urethritis (Alcamo, 2000). Complications of *Trichomonas vaginalis* reported in pregnant women include: premature rupture of membrane, premature labour, slow labour, low birth weight, abortion and post hysterectomy infection, infertility and neoplastic transformation in cervical tissues (Uneke *et al.*, 2006; Perazzi *et al.*, 2010; Soper, 2004).

According to Sobel (2005), trichomoniasis is also linked to increased mortality as well as predisposing factor to HIV infections and cervical cancers. Cervicitis due to trichomoniasis is characterized by purulent discharges in the endocervical canal and induces early endocervical bleeding (Workowski and Berman, 2006). Studies reveal that *T. vaginalis* induces immune activation specifically lymphocytes activation, replication and cytokine production leading to increased viral replication in HIV infected cells (Smith and Ramos, 2010). Symptomatic trichomoniasis is more common in women than in men but when parasitic organism is found in the anterior urethra, external genitalia, prostate, epididymis causes infertility in men (Smith and Ramos, 2010).

Factors such as poor personal hygiene, multiple sex partners, low socio-economic status and under development are documented to be associated with high incidence of infection (Crosby *et al.*, 2002). Over 180 million people are infected annually worldwide and 5 million in America (Bowden and

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Garnett, 2000; WHO, 2004). In Nigeria, it has been reported by previous workers that Sexually Transmitted Diseases (STDs) **have** been blamed on increase in poverty, unemployment and violence among women and children (Obiajuru, 2004; Ulogu *et al.*, 2007), among other factors sexual recklessness, lack of awareness, ignorance of the public health implications, poor sanitation and poor personal hygiene are other risk factors of trichomoniasis. -Prevention of *T. vaginalis* infection has not been a priority due to lack of understanding of its public health implications and lack of resources (Schwebke and Burgess, 2004).

There have been several reports of endemicity levels of *T.vaginalis* in Nigeria. Ekwulumili community (15.0%), Umunze community (13.3%), Kwampe community (3.3%), Nnewi community (21.53%), Jos (24.1%), Ilorin (4.7%) and Calabar (5.2%)— (Onyido *et al.*, 2014; Obiukwu *et al.*, 2010; Gundiri and Okwuosa, 2005; Ulogu *et al.*, 2007, Jombo *et al.*, 2006; Aboyeji and Nwabuisi, 2003; Usanga *et al.*, 2010). Studies reported 5.3% and 5.2%, 5.2% and 3.4% prevalence among single and married women respectively in Calabar and in Jos (Usanga *et al.*, 2009; Okojoku *et al.*, 2015). This presupposes that unmarried woman being unattached are free to indulge in more sexual activities probably involving multiple sexual partners (Usanga *et al.*, 2009).

The peak incidence of trichomonal infections is usually between 16 and 35 years of age (Naguils, 1996) also *T. vaginalis* infection is widely distributed among individuals between 20 and 45 years of age- (Onyido *et al.*, 2014). There are several reports on the prevalence of trichomoniasis among the age groups in Nigeria. **Eight per cent (8.0%)** among those aged 40-49 years and 35.85% among the age group 50-59 years, 26% among female students aged 26-35 years of age, 2.6% in women aged 15 – 64 years was reported between January 2006 and October 2007, 35 – 44 years (18.2%) followed by 15 – 24 years (3.4%)–, 31-35years (36.00%), 20 - 25(35.83%) (Onyido *et al.*, 2014; Njoku *et al.*, 2000; Abdulazeez *et al.*, 2007; Sobel, 1997; Jombo *et al.*, 2006; –Alo *et al.*, 2012). **This high prevalence of trichomoniasis in age bracket-range 15 – 44 years may be due to the fact that women in these age groups are sexually active, also that age is a risk factor for sexually transmitted diseases in sexually active women around these age groups (Sobel, 1997; Jombe *et al.*, 2006).**

-Candidiasis on the other hand is associated with vaginal discharge and pruritis. The discharge appears to be like curded milk and deep erythma of vulva and vagina is often seen (Khan *et al.*, 2009). **The incidence of the infection is almost doubled in pregnancy women particularly in the third trimester, compared to the non-pregnant women.** Among various pathogenic species of fungi, *Candida* is the most prominent cause of fungal infections (Sullivan *et al.*, 1996). The genus *Candida*

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is composed of heterogeneous group of organisms and more than 17 different *Candida* species are implicated in human infections (Pfaller and Diekema, 2007). *C. albicans* is the most significant pathogenic species. Other *Candida* species include, *C. parapsilosis*, *C. dubliniensis* and *C. lusitania*.

C. albicans is a ~~diploid~~diploid fungus that grows both as ~~yeast~~yeast and ~~filamentous~~filamentous cells and a causal agent of ~~opportunistic~~opportunistic oral and ~~genital~~genital infections in humans (Ryan and Ray, 2004; Hedayati and Shafiei, 2010). Typically, *C. albicans* live as harmless commensals in the gastrointestinal and genitourinary tract and are found in over 80% of the human population without causing harmful effects, although overgrowth of the fungus results in ~~candidiasis~~candidiasis (Mardh *et al.*, 2003). However, this disease usually occurs in immunocompromised individuals, such as HIV-infected victims, transplant recipients, chemotherapy patients, and low birth-weight babies (Kabir *et al.*, 2012). The discharge appears to be like curded milk and deep erythma of vulva and vagina is often seen (Khan *et al.*, 2009). Several factors can be associated with increased rate of vaginal colonization by *C. albicans*: these include pregnancy, use of high oestrogen content and oral contraceptives (Akah *et al.*, 2010; Alli *et al.*, 2011), uncontrolled diabetes mellitus (CDC, 2002; Alli *et al.*, 2011), prolonged use of broad spectrum antibiotics (Mardh *et al.*, 2002; Alli *et al.*, 2011) which kill the good and beneficial bacteria, allowing yeast overgrowth, poor dietary habits and poor personal hygiene. Poorly supported risk factors include use of sponge, intrauterine devices (IUDs), diaphragms, condoms, orogenital sex, douching and intercourse (Mardh *et al.*, 2002, Reed *et al.*, 2003; Alli *et al.*, 2011) and diet with high glucose content (De Leon *et al.*, 2002; Akah *et al.*, 2010; Alli *et al.*, 2011). Indeed, evidence in favour of sexual transmission exists. For instance, infected partners commonly carry identical strains which orogenital transmission has been documented (Akah *et al.*, 2010; Alli *et al.*, 2011).

The incidence of the infection is almost in women. It always reoccurs during pregnancy as a result of the increased levels of estrogens and corticoids that reduce the vaginal defense mechanism against such opportunistic infections as *Candida* (Sobel, 1997). It has been estimated that up to 40% of pregnant women world-wide may have vaginal colonization by *Candida* species, a two-fold increase from the prevalence rate in non-pregnant women (Hay and Czeizel, 2007). Poor social economic status, inadequate knowledge, lack of diagnostic facilities and shortage of effective treatment all contribute to the high incidence of sexually transmitted and reproductive tract infections (Tyadal *et al.*, 1992; Burrow and Bueshing, 1999).

There have been several reports of endemicity levels of candidiasis in Nigeria. Maiduguri Nigeria showed 14.7% *C. albicans*, women at LUTH and Military Hospital, Lagos had (33.6%), women at

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Aminu Kano Teaching Hospital had 42.0%, 22.1% among women in Lagos (Ojiyi et al., 2012; Adeoye and Akande, 2007; Nwadioha et al., 2010; Anorlu et al., 2004). ~~Many researchers reported the prevalence rates of *C. albicans* among age groups.~~ Onianwah (2014) reported incidence of *C. albicans* infection of the urogenital tract of females age 18 to 45 in Port Harcourt Urban Area at 18.9%. -Aged 16 to 37 years in a rural community in the semi-arid zone showed 56.3%, aged 15 to 30 years in Port Harcourt had 38.3%. (Nwosu and Djieyeb-, 2007; Mbakwem et al., 2012). Dennis et al., (2012) revealed that the highest prevalence of *C. albicans* (32.1%) was observed in 22 to 26 years age group. Another report in Benin City showed, three age groups with high occurrence of Candida infection: 17 to 23 (51.7%), 24 to 30 (41.5%), and 31 to 37 (36.4%) years. ~~Though they worked with pregnant patients, but~~ age group 17 to 23 years with the highest infection (51.7%) was attributed to the group being the most sexually active age range which further strengthens the belief that sexual activity could contribute to a large extent, in the spread of the disease ~~-(Ononge et al., 2005; Okungbowa et al., 2003).~~ In Abakaliki South Eastern Nigeria, Adeoye *et al.*, (2009) in a study of the prevalence of *Trichomonas vaginalis* and *C. albicans* among 200 antenatal women, reported 27.5% *C. albicans*. Okungbowa *et al.*, (2003) reported that pregnant women had less prevalence of *C. albicans* 188 (23.2%) than non- pregnant women 623 (76.8%) and he attributed it to the number of pregnant women whose data were reviewed when compared with the number of non- pregnant women. Calabar recorded high incidence rate of *C. albicans* among pregnant women and non-pregnant women, Ilorin reported 37.8% among pregnant women, pregnant women 23 (51.1%) and non-pregnant women 12 (30.8%) in Irrua (Usanga et al., 2010; Aboyeji and Nwabuisi, 2003; Isibor et al., 2011). The high prevalence rate of *C. albicans* among pregnant women was attributed to increased oestrogen content, glycogen in the acidity of the vagina due to rich glycogen content of the vaginal mucosa (Isibor et al., 2005).

The aim of this study was to investigate *T. vaginalis* and *C. albicans* infections among women of reproductive age in Ihiala town.

The specific objectives were to determine:

1. The prevalence of co-infection of *T. vaginalis* and *C. albicans* among women in Ihiala
2. The rate of co-infection of *T. vaginalis* and *C. albicans* by age, marital status, gravidity, pregnancy status, educational status, occupational groups and contraceptive usage among women in Ihiala
3. The treatment habits of *T. vaginalis* and *C. albicans* infections among women in Ihiala

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2.0 MATERIALS AND METHODS

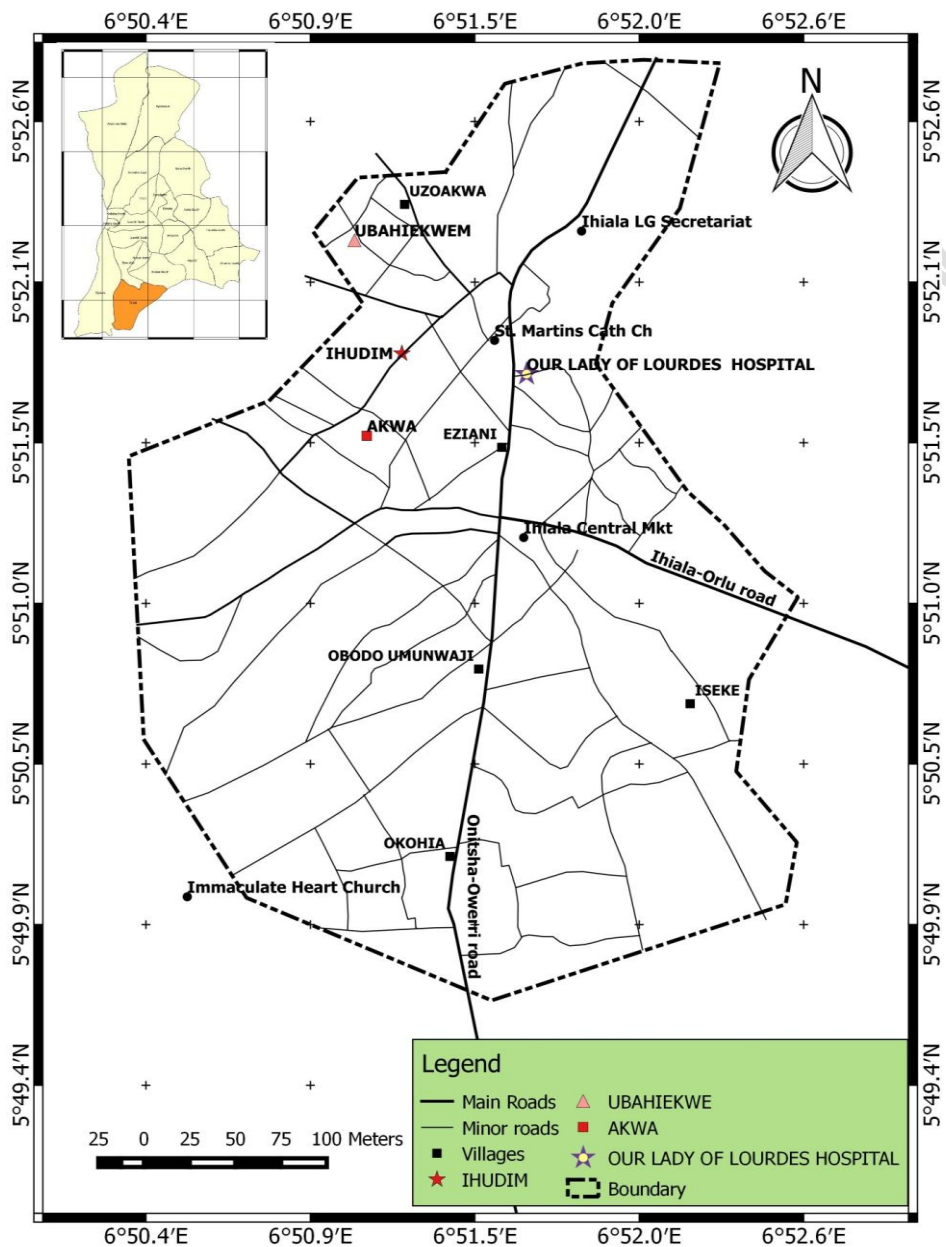
2.1 The Study Area

The study was carried out in Ihiala town ([Figure 1](#)) in Ihiala Local Government Area, of Anambra State, Southeastern Nigeria. Ihiala has long served as the local administrative capital of the zone (The World Gazetteer, 2007). Ihiala is situated between Longitude $6^{\circ}.86'$ East and Latitude $5^{\circ}.85'$ North of the equator. It is situated within the tropical rainforest zone of Nigeria. It has about 7 months of wet season period (April to October) and 5 months of dry season (November to March) with a short period of harmattan season. The relative humidity of the area is about 70% in the dry season reaching 80% during the wet season (Microsoft encarta, 2009). The annual rainfall is between 2,250 to 2,500 mm. The average daily temperature range of the area during the dry season is $27-33^{\circ}\text{C}$ and $21.1^{\circ}\text{C}-30^{\circ}\text{C}$ in wet season. The community is about 144_m above the sea level. Ihiala has a population of 87,796 inhabitants (NPC, 2006). The town is an Igbo speaking community living peacefully with people of other ethnic groups in Nigeria. The inhabitants (both indigenes and non-indigenes) are predominantly, farmers, traders, students and a few civil servants. They engage more in farming and trading.



Fig 1.Map of Anambra State showing Ihiala Local Government Area

Source: Anambra State Ministry of Lands and Survey (2012)



Source: Ihiala Local Government Area Town Planning Authority

Fig 2: Map of Ihiala town showing the villages where samples were collected

2.2 Study Design

The study was a cross-sectional survey of women of reproductive age in Ihiala town [\(Figure 2\)](#). Quantitative and qualitative methods were used to determine the prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates among the women participants in Ihiala. The study was conducted for a period of three months starting from January to March 2015.

2.3 Advocacy Visit and Mobilization of Participants

The participants were mobilized through town criers and public notices made in the churches within the villages. Health education on the health implications of infections with *T. vaginalis* and *C. albicans* was given to the participants. They were also informed that every laboratory test will be handled confidentially and it will also be free of charge. Informed consent was obtained from each woman before enrolment. The study was conducted in line with the international guideline for experimentation (WMADH, 2000).

2.4 Study Population and Sample Size Determination

According to Nigerian Census Commission, the population of women from Ihiala was 15,008 women (NPC, 2006). A total of seven hundred and thirty-four (734) apparently healthy women without complaints of infection were enrolled. The sample size (n) was determined using “Yaro Yamane” formula (Uzoagulu, 2011) for a finite population. The formula was given as:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- n = the minimum sample size
- N = the population size
- e = level of significance or limit of tolerable error (0.05)
- 1 = unity (a constant)

2.5 Sampling Technique

The women were assembled at the Akwa Health Centre, Ihiala and at Our Lady of Lourdes Hospital complex, Ihiala, for examination. Convenience sampling in which each woman was attended to as she arrived was used to study individual participants. Hospital examination rooms were used to provide each woman with the necessary privacy. Trained nurses and laboratory scientists assisted in swab collection and examination.

2.6 Specimen Collection

(a) Collection of Biodata of the Participants

A total of 734 structured questionnaires were used to obtain the biodata of the participants such as age, village, pregnancy status, occupation, marriage structure, gravidity, educational status and marital status.

(b) Collection of High Vaginal Swabs

Samples of vaginal discharge were carefully collected aseptically from the high vaginal area of the women using well labeled, sterile non-abrasive swab sticks through the assistance of two medical laboratory scientist in Our Lady of Lourdes Hospital laboratory, Ihiala and four nurses from Akwa Health Centre, Ihiala. The vaginal swabs were processed immediately after collection using hospital laboratory facility. Wet mounts were used to diagnose *T. vaginalis* while the swabs were cultured for *C. albicans*.

2.7 Parasitological examination of the specimens

(a) Diagnosis of *T. vaginalis* (Wet – Mount Preparation)

Each high vaginal swab from the women was mixed with a drop of sterile normal saline on a clean grease-free slide, covered with cover slip and examined with ~~x40~~-X10 objectives of the microscope. The presence of yeast cell, *T. vaginalis* and other deposits were noted. *T. vaginalis* was identified by the jerky movement, the flagella, axostyle and its oval shape. Ten percent (10%) Potassium hydroxide (KOH) was added to the wet preparation to increase the detection sensitivity of yeast cells, making the recognition of mycelia (pseudohyphae) much easier (Cheesbrough, 2000).

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(b) Diagnosis of *C. albicans* (Culture Method)

Each high vaginal swab was inoculated on Sabouraud Dextrose Agar gel and incubated at the temperature of 37°C for 48 hrs. Suspected yeast colonies and positive colonies were gram stained and further sub-cultured for germ tube test (Cheesbrough, 2000).

2.8 Data Analysis

The differences in the prevalence and co-infection of *T. vaginalis* and *C. albicans* in the various groups of the participants were tested using chi-square test. Chi-square statistics was computed to accompany each cross tabulation. The statistical package used was SPSS version 21.0.

3.0 RESULTS

-Out of the 734 women examined for the prevalence and co-infection of *T. vaginalis* and *C. albicans*, 150 (20.4%) were positive to only *C. albicans*, 7(1.0%) women were positive to *T. vaginalis* and 4(0.5%) had co- infection of *T. vaginalis* and *C. albicans* among the women (Table 1). *C. albicans* 150 (20.4%) had the highest prevalence, followed by *T. vaginalis* 7(1.0%) and co- infection had the least prevalence 4(0.5%) among the women participants.

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Table 1: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates among the women —participants from Ihiala-

No. Examined	No. infected with <i>C. albicans</i> (%)	No. infected with <i>T. Vaginalis</i> (%)	No. co-infected with <i>T. Vaginalis</i> and <i>C. albicans</i> (%)
734	150 (20.4)	7 (1.0)	4 (0.5)

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by age groups of the women are shown in Table 2. Of the 564 women in the age group 20-29 years, 2(0.4%) had only *T. vaginalis*, 96(17.0%) had *C. albicans* and 2(0.4%) had co-infection of the two pathogens. In the age group 30-39 years, 4(3.6%) of the 112 women examined had *T. vaginalis*, 32(28.6%) had *C. albicans*, and 2(1.8%) were co-infected with the parasites. Of the 58 women examined in the age group 40-49 years, 1(1.7%) was positive to only *T. vaginalis*, 22(37.9%) were positive to only *C. albicans* and none had co-infection of the parasites. The highest prevalence of *C. albicans* 22(37.9%) were recorded in women within the age bracket of 40-49 years while those within the age bracket of 20-29 years had the lowest prevalence 2(9.1%). The age bracket of 30-39 years had the highest prevalence of *T. vaginalis* only and co-infection 4(3.6) and 2(1.8), respectively. The age bracket of 40-49 recorded no co-infection (Table 2). The prevalence of *T. vaginalis* and *C. albicans* was significantly different ($P<0.05$) while their co-infection rates show a significant difference ($P>0.05$) among different age groups of the participants.

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Table 2: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by age groups

Age Group (Years)	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
20-29	564	2 (0.4)	96 (17.0)	2 (0.4)
30-39	112	4 (3.6)	32 (28.6)	2 (1.8)

40-49	58	1 (1.7)	22 (37.9)	0
Total	734	7 (0.95)	150 (20.4)	4 (0.5)

$$\chi^2 = 3.876, df = 3, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by location were shown in (Table 3). Of the 600 women from Eziani village, 102 (17.0%) had *C. albicans* and none had either *T. vaginalis* or co-infection of the parasites (Table 3). Of the 48 women from Ubahiekwem, 3 (6.3%) had only *T. vaginalis*, 18 (37.5%) had *C. albicans* only, and 3 (6.3%) had co-infection of both pathogens. Of the 56 women from Akwa village, 3 (5.4%) had *T. vaginalis*, 23 (41.1%) had *C. albicans*, and 1 (1.8%) had co-infection of those parasites. Of the 30 women from Ihudim village, 1 (3.3%) had *T. vaginalis*, 7 (23.3%) had *C. albicans* and none had co-infection of the parasites (Table 3). -Ubahiekwem 3 (6.3%) had the highest prevalence of *T. vaginalis* while Ihudim village had the least 1 (3.3%) and Eziani village had no *T. vaginalis*. Akwa village had the highest prevalence of *C. albicans* 23 (41.1%), followed by Ubahiekwem 18 (37.5%), and least was among Eziani village, 102 (17.0%). The co-infection was observed only among Ubahiekwem and Akwa village 3 (6.3%) and 1 (1.8%) respectively. Eziani and Ihudim village had no co-infection (Table 3). The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates among villages showed a significant difference ($P < 0.05$).

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Table 3: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by location

Villages examined	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Eziani	600	0	102 (17.0)	0
Ubahiekwem	48	3 (6.3)	18 (37.5)	3 (6.3)
Akwa	56	3 (5.4)	13 (41.1)	1 (1.8)
Ihudim	30	1 (3.3)	7 (23.3)	0
Total	734	7 (0.95)	150 (20.4)	4 (0.5)

$$\chi^2 = 3.876, df = 3, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by occupation of the participants was shown in Table 4. Of the 600 female students examined, none was positive with *T. vaginalis*, 102 (17.0%) had *C. albicans* only while none had co-infection (Table 4). Of the 18 civil servants examined, none had *T. vaginalis*, 3 (16.7%) were positive to *C. albicans* and no co-

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infection was recorded. Among the 30 traders examined, 4(13.3%) were positive to *T. vaginalis* only, 10(33.3%) had *C. albicans* only, while 2(6.7%) had co-infection of the parasites. Among the 86 farmers examined, 3(3.5%) were positive to *T. vaginalis* only, 35(40.7%) were positive to *C. albicans* and 2(2.3%) had co-infection of both (Table 4). Of all the four occupational groups that participated in the study, the highest prevalence of *C. albicans* 102(17.0%), was observed among the students, followed by 3(16.7%) observed among the civil servants while the least prevalence— 3(3.5%) was observed among farmers. The traders had the highest prevalence of *T. vaginalis* 4(13.3%) and co-infection of *T. vaginalis* and *C. albicans* 2(6.7%) (Table 4). The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates among women from different occupational groups showed a significant difference ($P<0.05$).

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Table 4: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by occupation

Occupation	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Students	600	0	102 (17.0)	0
Civil Servants	18	0	3 (16.7)	0
Trader	30	4 (13.3)	10 (33.3)	2 (6.7)
Farmers	86	3 (3.5)	35 (40.7)	2 (2.3)
Total	734	7 (0.95)	150 (20.4)	4 (0.5)

$$\chi^2 = 29.169, df = 3 \quad P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by marital status were shown in Table 5. Among the 468 single women examined, 91(19.4%) were positive to only *C. albicans*, none was positive to *T. vaginalis* and there was no co-infection of the parasites among them (Table 5).— Among the 234 married women examined, 6(2.6%) had only *T. vaginalis* and 55(23.5%) had only *C. albicans* while 4(1.7%) had co-infection (Table 5). Out of the 6 divorced women examined, 1(16.7%) had *C. albicans* and none had *T. vaginalis* or the co-infection of the parasites. Among the 26 widows examined, 1(3.8%) had *T. vaginalis* only, 3(11.5%) had *C. albicans* and none had co-infection (Table 5). The married women had the highest prevalence of *C. albicans*, and the widows had the least 1(11.5%). Only the married women had co-infection of *T. vaginalis* and *C. albicans* 4(1.7%) among the marital groups. The prevalence of *T. vaginalis* and co-infection rates had significant difference ($P<0.05$) while the prevalence in *C. albicans* had no significant difference ($P>0.05$).

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Table 5: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by marital status

Marital Status	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Singles	468	0	91 (19.4)	0
Married	234	6 (2.6)	55 (23.5)	4 (1.7)
Divorced	6	0	1 (16.7)	0
Widowed	26	1 (3.8)	3 (11.5)	0
Total	734	7 (0.95)	150 (20.4)	4 (0.5)

$$\chi^2 = 8.594, df = 3, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by educational status

of the participants were shown in Table 6. Among the 7 non-formal educational group examined, 4(57.1%) were positive to only *C. albicans*, 1(14.3%) was positive to *T. vaginalis* while 1(14.3%) had co-infection among them (Table 6). —Among the 42 primary educational group examined, 3(7.1%) had only *T. vaginalis*, 22(52.4%) had only *C. albicans* and 2(4.8%) had co-infection. Out of the 60 secondary educational group examined, 3(5.1%) had *T. vaginalis*, 25(41.7%) had *C. albicans* and 1(1.7%) had co-infection (Table 6). Out of the 625 tertiary educational groups examined, none had *T. vaginalis*, 99(15.8%) had *C. albicans* while none had co-infection. The highest co-infection of 1(14.3%) was observed among the non-formal educational group and the least was observed among the secondary educational group, 1(1.7%) (Table 6). The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates among the educational groups showed a significant difference ($P < 0.05$).

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Table 6: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by educational status

Educational Status	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Non-formal	7	1 (14.3)	4 (57.1)	1 (14.3)
Primary	42	3 (7.1)	22 (52.4)	2 (4.8)
Secondary	60	3 (5.1)	25 (41.7)	1 (1.7)
Tertiary	625	0	99 (15.8)	0
Total	734	7 (0.95)	150 (20.4)	4 (0.5)

$$\chi^2 = 42.983, df = 3, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by marriage structure of the women participants

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were shown in Table 7. Of the 206 monogamous women examined, 5(2.4%) had *T. vaginalis* only, 44(21.4%) had *C. albicans*, and 3(1.5%) had co-infection of the parasites (Table 7).— Among the 28 polygamous women examined, 1(3.6%) had *T. vaginalis*, 11(39.3%) had *C. albicans* and 1(3.6%) had co-infection of the parasites. The women from polygamous families had higher infections of *T. vaginalis* 1 (3.6%) and *C. albicans* 11 (39.3%) than the women from monogamous families with 5 (2.4%) *T. vaginalis* infection and 44(21.4%) of *C. albicans*. The women from polygamous families had higher co-infection rate 1 (3.6%) of *T. vaginalis* and *C. albicans* than the women from monogamous families 3 (1.5%) (Table 7). The prevalence of *T. vaginalis* and co-infection rates were significantly difference ($P<0.05$) while the prevalence in *C. albicans* had no significant difference ($P>0.05$) in marital structure.

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Table 7: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by marital structure

Marital Structure	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Monogamy	206	5 (2.4)	44 (21.4)	3 (14.3)
Polygamy	28	1 (3.6)	11 (39.3)	1 (3.6)

$$X^2 = 656, df = 1, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by pregnancy

status of the women participants were shown in Table 8. Of the 44 pregnant women examined, 1(2.3%) had *T. vaginalis*, 19(43.2%) had *C. albicans*, and none had co-infection among them (Table 8). Out of the 690 non-pregnant women examined, 131(18.98%) had *C. albicans*, 6(0.9%) had *T. vaginalis*, and 4(0.6%) had co-infection of the parasites (Table 8). The pregnant women had higher-low infection of *T. vaginalis* 1(2.3%) than the non-pregnant women 6(0.9%) (Table 8). There was no co-infection of *T. vaginalis* and *C. albicans* among the pregnant women. The prevalence of *T. vaginalis* and co-infection rates showed no significant difference ($P>0.05$) while the prevalence in *C. albicans* showed significant difference ($P<0.05$).

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Table 8: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by pregnancy status

Pregnancy Status	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Pregnant	44	1 (2.3)	19 (43.2)	0
Non-Pregnant	690	6 (0.9)	131 (18.98)	4 (0.5)
Total	734	7 (0.95)	150 (20.4)	4 (0.5)

$$X^2 = 256, df = 3, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates according to the gravidity of the women participants were shown in Table 9. Of the 458 nulligravida examined, 1(0.2%) had *T. vaginalis*, 74(16.2%) had *C. albicans*, none had co-infection among them (Table 9). Out of the 70 primigravida examined, 2(2.9%) had *T. vaginalis*, 9(12.9%) had *C. albicans* and 1(1.4%) had co-infection of the parasites. Out of the 206 multigravida women examined, 4(1.9%) had *T. vaginalis*, 67(32.5%) had *C. albicans*, and 3(1.5%) had co-infection among them. *T. vaginalis* infection was highest among primigravida 2(2.9%) and least 1(0.2%) among the nulligravida. *C. albicans* infection was highest among the multigravida 67(32.5%) and the least 9(12.9%) among the primigravida (Table 9). Co-infection of the parasites was not observed among the nulligravida. The multigravida had a higher rate of co-infection 3(1.5%) than the primigravida 1(1.4%) (Table 9). The prevalence of *C. albicans* and co-infection rates showed significant difference ($P > 0.05$) while the prevalence in *T. vaginalis* showed no significant difference ($P < 0.05$).

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Table 9: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by gravidity

Gravidity	No. examined	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Nulligravidae		458	1 (0.2)	4 (57.1)	0
Primigravidae		70	2 (2.9)	9 (12.9)	1 (1.4)
Multigravidae		206	4 (1.9)	67 (32.5)	3 (1.5)
Total		734	7 (0.95)	150 (20.4)	4 (0.5)

$$X^2 = 6.675, df = 3, P < 0.05$$

The prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates according to the Clinical manifestation

of the women participants were shown in Table 10. Of the 248 symptomatic participants examined, 2(0.8%) showed *T. vaginalis*, 62(25.0%) showed *C. albicans* and 2(0.8%) had co-infection among them (Table 10). Out of the 486(66.2) asymptomatic participants examined, 5 (1.0%) showed *T. vaginalis*, 40(8.2%) showed *C. albicans* and 2(0.4%) showed co-infection of the parasites (Table 10). Symptomatic women had 62(25.0%) higher prevalence of *C. albicans* compared to asymptomatic women 40(8.2%) (Table 10). Asymptomatic women 5 (1.0%) had higher prevalence of *T. vaginalis* than the symptomatic women. The co-infection occurred more among the symptomatic women 2(0.8) than asymptomatic women 2(0.4). The prevalence of *C. albicans* showed significant difference ($P > 0.05$) while the prevalence in *T. vaginalis* and co-infection rates showed no significant difference ($P < 0.05$).

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Table 10: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates by clinical manifestation among the women participants.

Clinical Manifestation	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Symptomatic	248 (33.8)	2 (0.8)	81 (32.7)	2 (0.8)
Asymptomatic	486 (66.2)	5 (1.0)	69 (14.2)	2 (0.4)
Total	734 (100)	7 (0.95)	150 (20.4)	4 (0.5)

$$X^2 = 0.473, df=2, P < 0.05$$

Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates according to treatment habit of the women participants

From the results obtained, women using Metronidazole always, had a higher prevalence of *C. albicans* infection 122 (23.5%), no co-infection of the two parasites and had the least *T. vaginalis* 1(0.2%) while women who do not take Metronidazole always had the lowest prevalence of *C. albicans* infection 28(13.1%), had highest co-infection 4(1.9%) and highest *T. vaginalis* 6(2.8%) (Table 11). There was no statistical difference between them ($P > 0.05$). Out of 534 women examined under self-medication had the higher prevalence of *C. albicans* infection 138 (25.8%), *T. vaginalis* 6(1.1%) and co-infection 3(0.6%) while 200 women examined without self-medication had *C. albicans* infection 12 (6.0%), *T. vaginalis* 200(0.5%) and co-infection 1(0.5%) (Table 11).

Of the 186 women examined under family planning showed the highest prevalence *C. albicans* infection 122 (65.6%), *T. vaginalis* 5(2.7%) and co-infection 2(1.1%) while 548 women examined with no family planning showed *C. albicans* infection 28 (5.1%), *T. vaginalis* 2(0.4%) and co-infection 2(0.4%) (Table 11).

Table 11: Prevalence of *T. vaginalis* and *C. albicans* and their co-infection rates according to treatment habit of the women participants.

Treatment Habit	No. Examined	No. infected with <i>T. vaginalis</i> (%)	No. infected with <i>C. albicans</i> (%)	No. co-infected with <i>T. vaginalis</i> and <i>C. albicans</i> (%)
Use of Metronidazole	Yes 520	1 (0.2)	122 (23.5)	0
	No 214	6 (2.8)	28 (13.1)	4 (1.9)
Self-medication of antibiotics	Yes 534	6 (1.1)	138 (25.8)	3 (0.6)
	No 200	1 (0.5)	12 (6.0)	1 (0.5)
Use of Contraceptives	Yes 186	5 (2.7)	122 (65.6)	2 (1.1)
	No 548	2 (0.4)	28 (5.1)	2 (0.4)

$$X^2 = 4.800, df = 3, P < 0.05$$

4.0 DISCUSSION

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This study showed that out of the 734 women examined, 150 (20.4%) had *C. albicans*, 7 (1.0%) had *T. vaginalis* while 4 (0.5%) had co-infection of *T. vaginalis* and *C. albicans*. Also the prevalence of candidiasis is relatively higher than trichomoniasis. The high prevalence of *C. albicans* (20.4%) reported in this study could be attributed to the fact that *C. albicans* is a frequent colonizer and responsible for most cases of vulvovaginitis (Singh, 2003; Akah *et al.*, 2010; Donbraye-Emmanuel *et al.*, 2010; Alli *et al.*, 2011). The result is higher than what was reported by previous researchers, Choudhry *et al.*, 2010; Konje *et al.*, 1991; Nwokedi and Aniyam, 2003; Cronje *et al.*, 1994; Di Bartolomeo *et al.*, 2002, who recorded 2.0%, 2.20%, 12.0%, 2.6%, and 17.8% respectively in their studies. However, this is lower than the findings of Khan *et al.*, (2009); Muvunyi and Hernandez, (2009); Usanga *et al.* (2010) and Adeoye and Akande (2007) who reported the prevalence rate of 28.0%, 52.5%, 21.3% and 33.6% -respectively. It is also lower than the 40.0%, reported by Oyewole *et al.* (2010), among non-HIV--infected women in Sagamu, Ogun State, Nigeria. It is also lower than 29.7% reported by Hedayati and Shafiei (2010) in their study and the 78.0% reported by Rizvi and Luby (2004) among Nepalese women, 70.0% reported by Nwankwo *et al.* (2010) among females of reproductive age in Kano, Nigeria, and the 65.4% reported by Donbraye-Emmanuel *et al.* (2010). Many other studies reported higher prevalence of candidiasis among women of reproductive age (Rao *et al.*, 2004; Nwadioha *et al.*, 2010; Murta *et al.*, 2000). The high prevalence 150(20.4%) of *C. albicans* observed in this study could be that candidiasis is spreading as a result of its invasive colonization of human host either due to health condition or due to sexual activities. This agrees with Horn *et al.*, (2009) who reported that high incidence of *C. albicans* could be associated with severe immunosuppression or illness, and sexual activities of the woman. *Candida* species are part of the lower genital tract flora in 20-50% of healthy asymptomatic women and may spread due to sexual activities or immunosuppression (McClelland *et al.*, 2009; Akah *et al.*, 2010).

High prevalence of *C. albicans* was recorded among age groups 20-29 years (17.0%), 30-39 years (28.6%) and 40-49 years (55.6%). This disagrees with the findings of previous studies by Konje *et al.* (1991) who observed that the infections were almost uniformly distributed in all age groups studied. This result did not support the findings of Engberts *et al.* (2006) who reported the prevalence of *C. albicans* to be significantly higher in cohort of 30 years ~~old~~ Dutch women and lower in the cohorts of 45-50, 55 and 60 years ~~old~~ Dutch women. However, the result disagrees with Adad *et al.* (2001), who reported that infection by *C. albicans* were most frequent among younger patients, especially those under 20 years. Also, Murta *et al.* (2005) reported that the frequency of *Candida* species is a less common feature among ages between 40 years and 49 years. The highest prevalence rate of Candidiasis was found amongst

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women in age 40-49 years and could be due to higher oestrogen content of the vaginal epithelial (Sobel, 1997). Also, the age range of between 20-49 years constitute the sexually active period of most women. This conforms to the findings of previous studies by Pfaller and Diekema (2007) who pointed out that, although *C. albicans* infection is not a classical sexually transmitted disease, it is known to be transmitted, in some cases, through sexual intercourse especially among sexually active person and sex workers. Ononge *et al* (2005) also reported that the high prevalence rate found in the younger age was attributed to the group being the most sexually active age range which further strengthens the belief that sexual activity could contribute to a large extent, the spread of the disease.

The low prevalence rate of trichomoniasis (1.0%) recorded in this study is similar to the result of Aboyeji and Nwabuisi (2003) who reported 4.7%. - Also, it is in tandem with low prevalence of (2.3%) and (3.3%) reported by Orji (2015) and Gundiri and Okwuosa (2005). Although, estimated global prevalence of *T. vaginalis* is 8.1% for women in Africa. It is estimated that 2-50% of the population has the infection (WHO, 1992). Various studies in other countries have also shown a low prevalence of trichomoniasis among reproductive age women. Kalantari *et al.* (2014) recorded prevalence rate of 0.2% in Babol in Iran, Nsagha *et al.* (2015) reported 1.2%, Shutter *et al.* (1998) and Franklin and Monif (2000) recorded the prevalence of 46.9% and 36.1% respectively. However some studies have reported higher prevalence rates, Lopez-monteon (2013), Jombo *et al.* (2006) and Alo *et al.* (2012) recorded prevalence of 23.4%, 24.1% and 24% respectively. This result also disagrees with Ulogu *et al.* (2007) who observed a prevalence rate of 21.53% among women in Nnewi community. Low prevalence of *T. vaginalis* in Ihiala could be attributed to multiple factors such as awareness of people towards the spread of human immunodeficiency virus (HIV) due to public campaign by World Health Organization (WHO) and other agencies in Nigeria and abroad. This has led to a change in attitude of people towards unsafe sex and increase in the use of condoms. The use of condom has helped in reducing organisms especially *T. vaginalis* that affects the vaginal mucosa in women. This is in concordance with the findings of Evans *et al.* (1995). It is also likely to be associated with the frequent use of Metronidazole (Flagyl) tablets, which is taken very often even without doctor's prescription for any intestinal problems. Many people take the drugs in any case of diarrhoea or stomach arch, indirectly treating trichomoniasis without knowing.

The co-infection rate of trichomoniasis and candidiasis in this study was 0.5% with only 4 participants infected. This is similar to the findings of Adeoye and Akande (2007) who reported co-infection rate of 0.6% of *T. vaginalis* and *C. albicans* in Lagos metropolis. Olorode *et al.* (2014) reported co-infection rate of 3.2% which is slightly higher. However, higher rate of co-infection of trichomoniasis and candidiasis has been reported by other studies. Lopez-monteon (2013) reported co-infection rate of 14.28% in central

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Veracruz Mexico while Alo *et al.* (2012) recorded 22% co-infection rate in Abakaliki, Ebonyi State. Low co-infection rate of the parasites observed in this study could be attributed to improved life style, especially in personal hygiene and literacy in reproductive health, as well as the use of Metronidazole in treatment of other protozoal infections.

Also, co-infection of trichomoniasis and candidiasis were recorded among younger women peaking at 3.6% and 1.8% in age group 30-39. This study attributed the high increase rate of the co-infection among the age group 30-39 to be more sexually active. This is in conformity with the study of Donbraye *et al.* (2010) where higher prevalence of co-infection of trichomoniasis and candidiasis was reported among young age group.

5.0 CONCLUSION AND RECOMMENDATION

The study has revealed that infections caused by *T. vaginalis* and *C. albicans* and their co-infections exist among women of reproductive age in Ihiala. The data generated will provide baseline information for the formulation of policies and control strategies for the control of the infections. In addition, it will be useful in educating the women of reproductive age to be more conscious of their reproductive health. It is therefore suggested that mass diagnosis and treatment coupled with health education will help to eradicate the infections in Ihiala town.

REFERENCES

- Abdulazeez, A. Alo, E. and Livingstone, R. (2007). Epidemiology of urinogenital trichomoniasis in a north-eastern State, Nigeria. *The Internet Journal Of Parasitic Diseases*. **2** (2).
- Aboyaji, A.P. and Nwabuisi, C. (2003). Prevalence of sexually transmitted diseases among pregnant women in Ilorin, Nigeria. *Journal of Obstetrics and Gynecology*. **23**(6), 637-639.
- Adad, S.J., De Lima, R.V., Sawan, Z.T., Silva, M.L., De Souza, M.A., Saldanha, J.C., Falco, V.A., Da Cunha, A.H. and Murta, E.F. (2001). Frequency of *Trichomonas vaginalis*, *Candida*, *species*, and *Gardnerella vaginalis* in cervical-vaginal smears in four different decades. *Sao Paulo Medical Journal*. **119**(6):200-205.
- Adeoye, G.O. and Akande, A.H., (2007). Epidemiology of *Trichomonas vaginalis* among women in Lagos Metropolis, Nigeria. *Pakistan Journal of Biological Science*. **10**: 2198-2201.

- Adeoye, J.O.K., Umeora, O.U. and Okonta, P.I. (2009). The prevalence of *Trichomonas Vaginalis* and *candida albicans* infection in lower genital tracts of antenatal patients in Abakaliki, South Eastern Nigeria. *Neped Journal of obstetrics Gynaecology*. **4**(1):11-14.
- Adu-Sarkodie, Y. (2004). *Trichomonas vaginalis* screening goes global. *Journal of Sexual Transmitted Infections*. **80**: 201-203.
- Agboola, A. (2006). *Vaginal Discharge*: In the Textbook of Obstetrics and Gynecology for Medical Students; 2nd edition Heinemann Educational Books (Nigeria) plc. pp548.
- Akah, P.A., Nnamani, C.E. and Nnamani, P.O. (2010). Prevalence and treatment outcome of vulvovaginal candidiasis in pregnancy in a rural community in Enugu State, Nigeria. *Journal of Medicine and -Medical Sciences*. **1**(10): 447-452.
- Alcamo, I.E. (2000). *Fundamentals of microbiology*. Jones and Bartlett Publishers, Boston.p: 486-487.
- Al-Hindi, A.I. and Lubbad, A.M.H. (2006). *Trichomonas vaginalis* infection among Palestinian women: prevalence and trends during 2000-2006. *Turky Journal of Medical Science*. **36**: 371-375.
- Alli, J.A.O., Okonko, I.O., Odu, N.N., Kolade, A.F. and Nwanze, J.C. (2011). Detection and prevalence of *Candida* isolates among patients in Ibadan, Southwestern Nigeria. *Journal of Microbiology and Biotechnology Research* **1**(3): 176-184.
- Alo, M.N., Anyim, C., Onyebuchi, A.K. and Okonkwo, E.C. (2012). Prevalence of asymptomatic Co-Infection of Candidiasis and Vaginal Trichomoniasis among Pregnant Women in Abakaliki, South-Eastern Nigeria. *Journal of Natural Sciences Research*. **2**(7): 2224-3186.
- Anambra State Ministry of Lands and Survey. (2012). Map of Anambra State showing Ihiala Local Government Area
- Anderson, M., Korasz, A. and Friedlands. (2004). Are vaginal symptoms ever normal. A review of the literature. *General Medicine*. **6**(4):49-55.
- Anorlu, R., Imosemi, D., Odunukwe, N., Abudu, O. and Otuonye, M. (2004). Prevalence of HIV among women with vaginal discharge in a gynecological clinic. *National Medical Association*. **96**(3): 367-371.
- Anosike, J.C., Onwuliri, C.O., Inyang, R.E., Nwoke, B.E., Okoye, S.N. and Akogun, O.B. (1993). *Trichomonas* among Students of Higher Institutions in Nigeria. *Applied Parasitology*. **34**:19-25.
- Bairy, I., Balachandran, C. and Shivananda, P.G. (2001). HIV seropositivity in STD clinic attendants. *Indian Journal of Sexual Transmission Diseases* **22**: 6-9.
- Bajaj, J.K., Kulkarni, J.D., Damle, A.S., Patwardhan, N.S., Karyakarte, R.P and Deshmukh, A.B. (2000). HIV seropositivity in STD patients. ~~Indian Journal~~ *Indian Journal of Medical Microbiology* **18**: 44.
- Bowden, F.J, and Garneth, G.P. (2000). *Trichomonas vaginalis* epidemiology paramaterising and analyzing of model of treatment interventions. *Sexually Transmitted Infections*, 76:248-256
- Brown, M.T. (1992). Trichomoniasis: *Practitioner*. **201**: 639-641.

- Burrow, R.C. and Bueshing, U.J. (1999). Bacterial vaginosis in virgins and sexually active females: Evidence against exclusive sexual transmission. *Journal of Obstetrics Gynecology*. 8(5): 97 -99.
- Burtin, P., Taddio, A., Ariburnu, O., Einarson, T.R. and Koren, G. (1995). Safety of Metronidazole in pregnancy: a meta-analysis. *American Journal of Obstetrics Gynecology*. 172(2 Pt 1):525–9.
- Calderone, R. A. & Fonzi, W. A. (2001). Virulence factors of *Candida albicans*. *Trends in Microbiology* 9: 327–335.
- Caro-Paton, T., Carvajal, A., Martin de Diego, I., Martin-Arias, L.H., Alvarez Requejo, A. and Rodriguez Pinilla, E. (1997). Is Metronidazole teratogenic? A meta-analysis. *British Journal of Clinical Pharmacology*. 44(2):179–82.
- Centre for Disease Control and Prevention (2002). Sexually Transmitted Diseases Guidelines. *Morbidity and Mortality Weekly Recommendation Report*. 51 (RR-6): 1 – 78.
- Centre for Disease control and Prevention, (2006). Sexually transmitted diseases treatment guideline. *Morbidity and Mortality Weekly Recommendation Report*: 55(RR11): 1-94.
- Centre for Disease Control. (2015). Complete treatment guidelines for Trichomoniasis. MMWR 64:72-75. <http://www.cdc.gov/std/treatment/2010/vaginal-discharge.htm>. (Accessed March 28, 2012).
- Chin, J. (1990). Public health surveillance of AIDS and HIV infections. *Bulletin of World Health Organization* 68: 529-536.
- Cheesbrough, M. (2000). *Microbiological test in: District laboratory practice for tropical countries part 2*, Cambridge Low Price Edition. Cambridge University Press. pp. 69-71.
- Choudhry, S., Ramachandran, V.G., Das, S., Bhattacharya, S.N. and Mogha, N.S. (2010). Pattern of sexually transmitted infections and performance of syndromic management against etiological diagnosis in patients attending the sexually transmitted infection clinic of a tertiary care hospital. *Indian Journal Of Sexual Transmitted Diseases*. 31:104-8.
- Colombo, A. L. and Guimaraes, T. (2003). Epidemiology of hematogenous infections due to *Candida species* (in Portuguese). *Review Society Bras Medical Tropics*. 36: 599–607.
- Colombo, A. L., Nucci, M., Park, B. J., Nouer, S. A., Arthington- Skaggs, B., Da Matta, D. A., Warnock, D. and Morgan, J. (2006). Brazilian Network Candidemia Study. Epidemiology of candidemia in Brazil: a nationwide sentinel surveillance of candidemia in eleven medical centers. *Journal of Clinical Microbiology*. 44:2816–2823.
- Cronje, H.S., Joubert, G., Muir, A., Chapman, R.D., Divan, P. and Barn, R.H. (1994). Prevalence of vaginitis, syphilis and HIV infection in women in the Orange Free State. *South African Medical Journal*. 84: 602-605.
- Crosby, R., DiClemente, R.J. and Wingwood, G.M. (2002). Predictions of infection with *Trichomonas vaginalis*: a prospective study of low -income African-American adolescent females. *Sexually Transmitted Infections*. 78: 360-364.
- Cudmore, S.L., Delgathy, K.L., Hayward-Mcdell, S.F., Petrin, D.P. and Garber, G.E. (2004). Treatment of Infections caused by Metronidazole Resistant *Trichomonas vaginalis*. *Clinical Microbiology Review*. 17(4): 783-793.

- Cudmore, S.L. and Garber, G.E. (2010). Prevention or treatment: the benefits of *Trichomonas vaginalis* vaccine. *Journal Of Infectious Public Health*. P: **3**(2):47–53.
- Cullen, P. J. & Sprague, G. F., Jr (2012). The regulation of filamentous growth in yeast. *Genetics* **190**: 23–49.
- Diamond, L. S. (1980). In vitro of cultivation of the Trichomonas. *A state of Art Review*. Acta. University of Caro.**30**:227-229.
- Dennis, O.U., Agu, M.C., Nwenyi, U. N. and Agu, U. (2012). Epidemiology of *Candida* vaginitis in women of reproductive age in selected hospitals in Onitsha metropolis, Anambra state, Nigeria and its environs. *Journal of Public Health and Epidemiology*. **5**(11), pp. 459-562.
- De Leon, E.M., Jacober, S.J., Sobel, J.D. and Foxman, B. (2002). Prevalence and risk factors for vaginal *Candida* colonization in women with type 1 and type 2 diabetes. *BMC Infectious Diseases*. **2**(1): doi:10.1186/1471-2334-2-1.
- De Repentigny, L., Lewandowski, D. and Jolicoeur, P. (2004). Immunopathogenesis of oropharyngeal candidiasis in human immunodeficiency virus infection. *Journal of Clinical Microbiology Review*. **17**(4):729-759.
- Di Bartolomeo, S., Rodriguez Fermepin, M., Sauka, D.H. and Alberto de Torres, R. (2002). Prevalence of associated micro-organisms in genital discharge, Argentina. *Review Saude Publication*. **36**(5):545-552.
- Donbraye, E., Okonkwo, I.O. and Okedeji, I.O. (2010). Detection and prevalence of *Trichomonas vaginalis* among pregnant women in Ibadan, South Western Nigeria. *World Applied Science Journal*. **11**(12), 1512-1517.
- Edrisian, Q., Rezaiian, M., Qorbani, M., Keshavarz, H. and Mohebbali, M. (2006) *Medical porotozoology*. 1 edition Tehran: Tehran universal publication. p. 85-95.
- Edwards, J. E. Mandell, G.L., Bennett, J.E. and Dolin, R. (2009). *Candida* Species. In (Eds.), Mandell, Douglas, and Bennett's Principles and Practices of Infectious Diseases. USA: (c) Churchill Livingston, New York. (7th edition).
- Engberts, M.K., Vermeulen, C.F., Verbruggen, B.S., Van Haaften, M., Boon, M.E. and Heintz, A.P. (2006). *Candida* and squamous (pre) neoplasia of immigrants and Dutch women as established in population- based cervical screening. *Internet Journal of Gynecological Cancer*. **16**(4):1596-1600.
- Evans, B. A., Bond, P.D. and MacRae, K.D. (1995). Heterosexual relationship and Condom use in the spread of sexual transmitted diseases to woman. *Genito-urinary Medicine* **71**(5): 291-294.
- Fanelloa, S., Boucharab, J.P., Jousseta, N., Delbosa, V. and LeFlohicc, A.M. (2001). Nosocomial *Candida albicans* acquisition in a geriatric unit: epidemiology and evidence for person-to-person transmission. *Journal of Hospital Infection*. **47**(1):46-52.
- Faro S. (2004). Vaginitis. Differential diagnosis and management. New York: Parthenon Publishing Group.

- Franklin, T.L. and Monif, G.R. (2000). *Trichomonas vaginalis* and bacterial vaginosis. Co-existence in vaginal wet mount preparations from pregnant women. *Journal of Reproductive Medicine*, **45**(2): 131-134
- Garland, S.M. (2001). *Trichomonas vaginalis*: why we should be screening. *Venereology*. **14**: 116-120.
- Germain, M., Krohn, M.A., Hillier, S.L. and Eschenbach, D.A. (1994). Genital flora in pregnancy and its association with intra-uterine growth retardation. *Journal of Clinical and Microbiology*. **32**: 2162-2168.
- Graves, A. and Gardner, W.A. (1993). Pathogenicity of *Trichomonas vaginalis*. *Journal of Clinical Obstetrics Gynecology*. **36**: 145-151.
- Gundiri, M.A. and Okwuosa, V.N. (2005). Prevalence of urinary and intestinal tracts parasites in Kwampe, Langtong, North Nigeria. *Nigerian Journal of Parasitology*. **26**:19-22.
- Guler, S., Ural, O., Findik, D. and Arslan, U. (2006). Risk factors for nosocomial candiduria. *Journal of Saudi Medicine*. **27**:1706–1710.
- Hay, P. and Czeizel, A.E. (2007). Asymptomatic *Trichomonas* and *Candida* colonization and pregnancy outcome. *Basic Practice and Research Clinical Obstetrics Gynecology*. **21**(3), 403-409.
- Hedayati, T. and Shafiei, G. (2010). Candidiasis. *eMedicine Specialties*. **21**(2): 90- 93.
- Heine, P. and McGregor, J.A. (1993) *Trichomonas vaginalis*: a reemerging pathogen. *Journal Of Clinical Obstetrics Gynecology*. **36**:137-144.
- Herbst, A.I., Mitshell, D.R., Stenchever, M.A. and Droegemueller, E. (1992). Comprehensive gynaecology, Missouri. *Mosby yearbook*. **21**(2): 40- 62.
- Hobbs, M.M., Lapple, D.M., Lawing, L.F., Schwebke, J.R., Cohen, M.S. and Swygard, H. (2006). Methods for detection of *Trichomonas vaginalis* in the male partners of infected women: implications for control of trichomoniasis. *Journal Clinical Microbiology*. **44**(11):3994-9.
- Horn, D. L., Neofytos, D., Anaissie, E. J., Fishman, J. A., Steinbach, W. J., Olyaei, A. J., Marr, K. A., Pfaller, M. A., Chang, C. H. and Webster, K. M. (2009). Epidemiology and outcomes of candidemia in 2019 patients: data from the prospective antifungal therapy alliance registry. *Journal of Clinical Infectious Diseases*. **48**: 1695–1703.
- Honigberg, B.M. (2000). *Trichomonads parasitic in human*. Spring Veriag, New York. Pp:53-54.
- Huppert, J.S. (2009). Trichomoniasis in teens: an update. *Current Opinion in Obstetrics and Gynecology* **21** (5): 371-378.
- Ingham, C. J., Boonstra, S., Levels, S., De Lange, M., Meis, J. F. and Schneeberger, P. M. (2012). Rapid susceptibility testing and microcolony analysis of *Candida species* cultured and imaged on porous aluminum oxide. *PLOS ONE* **7**. e33818.
- Iwueze, M.O., Ezeanyanwu, L.N. Okafor, F.C. Nwaorgu, O.C. and Ukibe, S.C. (2014). Prevalence of *Trichomonas vaginalis* infection among women attending hospitals/health centres in onitsha

- community, Onitsha North Local Government Area of Anambra state. *The Bioscientist*, **2**(1): 54-64
- Jatau, E. D., Olonitola, O. S. and Olayinka, A. T. (2006). Prevalence of *Trichomonas* Infection among Women Attending Antenatal Clinics in Zaria, Nigeria. *Journal Of Annals of African Medicine*. Vol. 5. **4**: 178 – 181.
- Jombo, G. T., Opayobi, S. O. and Hobbs, N.M. (2007). Trichonomiasis. *The Internet Journal of parasitic diseases* **8**: 67-88.
- Jombo, G.T.A., Ega, D.Z., Banwate, E.R. and Opajobi, S.O. (2006). High vaginal and endocervicals swab: A bacteriological study of 8, 433 samples in Jos, Nigeria. *Journal of Medical Laboratory Science*. **15**(2), 41-46.
- Kabir, M.A., Hussain, M.A. and Ahmad, Z. (2012). *Candida albicans*: A Model Organism for Studying Fungal Pathogens. *Journal of Microbiology*. 538-694.
- Kalantari, N., Ghaffari, S. and Bayani, M. (2014). *Trichomonas*, *Candida*, and *Gardnerella* in cervical smears of Iranian women for cancer screening. *North American Journal of Medical Science*. **6**: 25-90.
- Khan, A.S., Amir, F., Altaf, S. and Tanveer, R. (2009). Evaluation of common organisms causing vaginal discharge. *Journal of Ayub. Medicine Coll. Abbottabad*. **21**(2): 90- 93.
- Khandpur, S., Agarwal, S., Kumar, S., Sharma, V.K and Reddy, B.S. (2001). Clinico-epidemiological profile and HIV seropositivity of STD patients. *Indian Journal of Sexual Transmission Diseases* **22**: 62-65.
- Khanna, N., R.K. Pandhi and S. Lakshmi Pal, (1996). Changing trends in sexually transmitted diseases in Chandigarh. *Indian Journal of Sexual Transmission Diseases* **17**: 79-81.
- Kim, J. and Sudbery, P. (2011). *Candida albicans*, a major human fungal pathogen. *Journal of Microbiology*. **49**: 171–177.
- Kissinger, P. (2015). *Trichomonas vaginalis*: A review of epidemiologic, clinical and treatment issues. *BMC Infectious Diseases*, **15**: 307
- Klotz, S. A., Chasin, B. S., Powell, B., Gaur, N. K. and Lipke, P. N. (2007b). Polymicrobial bloodstream infections involving *Candida species*: analysis of patients and review of the literature. *Diagnosis of Microbiology Infectious Diseases*. **59**: 401–406.
- Kojic, E. M. & Darouiche, R. O. (2004). *Candida* infections of medical devices. *Clinical Microbiology Review* **17**: 255–267.
- Konje, J.C., Olorin, E.O., Ogunniyi, J.O., Obisesan, K.A. and Ladipo, O.A. (1991). The prevalence of *Gardnerella vaginalis*, *Trichomonas vaginalis* and *Candida albicans* in the Cytology clinic at Ibadan Nigeria. *African Journal Medical Sciences*. **20**(1): 29-34.
- Laga, M., Manoka, A. and Kivuvu, M. (1993). Non-ulcerative sexually transmitted diseases risk factors for HIV-1 transmission in women: results from a cohort study. *AIDS*. **7**: 95-102.

- Lehker, M. W. And Alderete, J. F. (1999). "Resolution of Six Chromosomes of *Trichomonas vaginalis* and Conservation of Size and Number among Isolates". *The Journal of Parasitology*. **85** (5): 976–979.
- Li, C.D., Zhang, W.Y., Wu, M.H., Zhang, S.W., Zhou, B.L., Zhu, L., Pan, J. and Wang, J.D. (2003). Analysis of high risk factors associated with cervical intraepithelial neoplasia in married women aged 25–54 years in Beijing. *Zhonghua Fu Chan Ke Za Zhi*. **45**(10):757–761.
- Lim, C. S., Rosli, R., Seow, H. F. and Chong, P. P. (2012). *Candida* and invasive candidiasis: back to basics. *European Journal of Clinical Microbiology Infectious Diseases*. **31**: 21–31.
- Lopez Monteon, A., Gomes Figueroa, F.S., Ramos Poceros, G., Guzman Gomez, D. and Ramos Ligonio, A. (2013). Codetection of *Trichomonas vaginalis* and *Candida albicans* by PCR in Urine Samples in a Low Risk Population Attended in a Clinic First Level in Central Veracruz, Mexico. *Biomed Research International*.
- [Madani, A.T. \(2006\). Sexually transmitted infections in Saudi Arabia. *BMC Infectious Diseases*. 6: 3.](#)
- Mårdh, P. A., Novikova, N. and Stukalova, E. (2003). [Colonisation of extragenital sites by *Candida* in women with recurrent vulvovaginal candidosis](#). *BJOG*. **110** (10): 934-7.
- Mardh, P.A., Rodrigues, A.G. and Genc, M. (2002). Facts and myths on recurrent vulvovaginal candidosis: a review on epidemiology, clinical manifestations, diagnosis, pathogenesis and therapy. *International Journal of Sexual Transmitted Diseases and AIDS*. **13**(8): 522-539.
- Mavedzenge, S. N., Van Der Pol, Chang, H., Montgomery, E. T., Blanchard, K., De Bruyn, G., Ramjee, G. and Van der straten, A. (2010). "Epidemiological Synergy of *Trichomonas vaginalis* and HIV in Zimbabwean and South". *Journal of Sexually Transmitted Diseases*. **37**(7): 460-6.
- Mbakwem, C., Aniebo, C. and Suka, S. (2012). Prevalence of *candida albicans* in symptomatic vulvovaginitis in Port Harcourt, Nigeria. *Journal of Medical Organization article*. 10-12.
- McClelland, R.S., Richardson, B.A., Hassan, W.M., Graham, S.M., Kiarie, J., Baeten, J.M., Mandaliya, K., Jaoko, W., Ndinya-Achola, J.O. and Holmes, K.K. (2009). Prospective study of vaginal bacterial flora and other risk factors for vulvovaginal candidiasis. *Journal of Infectious Diseases*. **15**: 199(12): 1883-1890.
- Microsoft Encarta (2009). Microsoft Corporation 1993- 2009.
- Mulla, M., Summaiya, Kosambiya, J.K., Desai, D., Vikask, G., Shethwala, S. and Nimishad, G. (2009). "Sexually transmitted infections and reproductive tract infections in female sex workers". *Indian Journal of Pathology and Microbiology*. **52** (2): 198–209.
- Murta, E.F., Souza, M.A., Araújo Júnior, E. and Adad, S.J. (2000). Incidence of *Gardnerella vaginalis*, *Candida sp* and human papilloma virus in cytological smears. *Sao Paulo Medical Journal*. **118**(4):105-108.
- Murta, E.F., Silva, A.O., Silva, E.A. and Adad, S.J. (2005). Frequency of infections agents for vaginitis in non and hysterectomized women. *Archives of Gynecology and Obstetrics*. **273**(3):152-156.

- Muvunyi, C.M. and Hernandez, C.T. (2009). Prevalence of bacterial vaginosis in women with vaginal symptoms in south province, Rwanda. *African Journal Clinical- Experimental- Microbiology*. **10**(3):156-153.
- Naglik, J. R., Challacombe, S. J. and Hube, B. (2003). *Candida albicans* secreted aspartyl proteinases in virulence and pathogenesis. *Microbiology Molecule Biological Review*. **67**(3): 400–428.
- Naguils, S. (1966). Epidemiology of trichomoniasis in normal females. *Journal Of Obstetrics Gynecology*. **27**:607-620.
- National Population Commission (2006). Population Census of Nigeria. Population distribution in Local Government Areas by Sex and Number of Households.
- Nelson, A.L. and Woodward, J.A. (2006). Sexually transmitted diseases. *A Practical Guide for Primary Care*. New Jersey: Humana Press; p. 229-41.
- Nguyen, M.H., Peacock, J.E., Tanner, D.C., Morris, A.J., Nguyen, M.L., Snyderman, D.R., Wagener, M.M. and Yu, V.L. (1995). Therapeutic approaches in patients with candidemia. Evaluation in a multicenter, prospective, observational study. *Archives of Internal Medicine*. **155**(22):2429-35.
- Njoku, A.J., Obiajuru, J.O.G., Njoku, C.J., Nwankwo, E.A., Uwaezuoke, J.C. and Anosike, J.C. (2000). The Prevalence of *Trichomonas vaginalis* among Students of higher Institution in Imo State, Nigeria. *Journal of Parasitology*. **21**:83-94.
- Nsagha, D. S., Zofou, D., Nguedia Assob, J. C., Njunda, A. L., Nchang, C. D., MvoNgum, N., Weledji, E. P. and Ngowe, N. M. (2015). The epidemiology of *Trichomonas vaginalis*, *Gardnerella vaginalis* and *Candida albicans* co-Infections in women attending the Yaounde University Teaching Hospital. *American Journal of Epidemiology and Infectious Diseases*, **3**(2): 28-31.
- Nucci, M., Queiroz-Telles, F., Tobon, A. M., Restrepo, A. and Colombo, A. L. (2010). Epidemiology of opportunistic fungal infections in Latin America. *Journal of Clinical Infectious Diseases*. **51**: 561–570.
- Nwadioha, S., Egesie, J.O., Emejuo, H. and Iheanacho, E. (2010). Prevalence of pathogens of abnormal vaginal discharges in a Nigerian tertiary hospital. *Asian Pacific Journal of Tropical Medicine*. **3**(6): 483-485.
- Nwankwo, E.O.K., Kandakai-Olukemi, Y.T. and Shuaibu, S.A. (2010). Aetiologic Agents of Abnormal Vaginal Discharge among Females of Reproductive Age in Kano, Nigeria. *Journal of Medicine and Biomedical Sciences*. **1**:12-16.
- Nwokedi, E.E., Aniyam, N.N., (2003). A study of high vaginal swabs in Kano teaching hospital- A preliminary study. *Highland Medical Research Journal*. **1**: 57-61.
- Nwosu, C.O. and Djieye, P.N.A. (2007). Candidiasis and trichomoniasis among Pregnant women in a rural community in the semi-arid zone, North- eastern Nigeria. *West African Journal of Medicine*. **26**(1):17-19.
- Obiajuru, I.O.C. (2004). The prevalence of *Trichomonas vaginalis* infection in Imo State Nigeria, Unpublished M.Sc Thesis Imo-State University Owerri Nigeria.

- Obiukwu, M. O., Onyido, A. E., Duru, J. U and Aleke, O. (2010). *Trichomonas vaginalis* infection in Anambra State--: Demography and Behavioural predictors. *Journal of advancement in medical and Pharmaceutical Sciences*. **4**(1): 16-20.
- Orji, N.M. (2015). Reproductive tract infections among females in Ihiala Local Government Area, Anambra State, Nigeria. *International Journal of Scientific Engineering and Applied Science*, **1**(3): 22-28
- Ojiyi, E., Dike, E., Okendo, C., Anolue, F., Audu, B. and Ngadda, H. (2012). The prevalence and predictors of genital tract infections in cervical cytology specimens at university teaching hospital, Maiduguri, Nigeria. *The international Journal of Gynecology obstetrics*. **16**(1): DOI:10.5580/2971.
- Okojokwu, O.J., Akpakpan E.E., Kolawole O.T., Ndubuisi J.C., Okopi, J.A. (-2015). Epidemiology of *Trichomonas vaginalis* Infection among Women in Jos Metropolis, Nigeria. *Journal Of Biomedicine and Nursing*. **1**(3): 7-11.
- Okungbowa I.F., Isikuemhen, S.O. and Dede, P.O.A. (2003): The distribution frequency of *Candida species* in the genitourinary tract among symptomatic individuals in Nigerian cities. *Iberoam Micology*. **20**: 60 – 63.
- Olorode, O.A., Ogba, O.N. and Ezenobi, N.O. (2014). Urogenital trichomoniasis in women in relation to candidiasis and gonorrhoea in University of Port-Harcourt Teaching Hospital. *African Journal of Microbiology Research*. Vol **8**(2): 2482-2485.
- Onianwah, I.F. (2014). The Incidence and Prevalence of *Candida albicans* infection of the urogenital tract of females between the ages of 18 and 45 years old: A Case study of Patients receiving treatment in Ashford and Patrice clinic in Port Harcourt. *International Research Journal of Environment Sciences*. **3**(4), 101-104.
- Ononge, S., Wondabwa, J., Kionto, P. and Busigye, R. (2005). Clinical presentation and management of alleged sexually assaulted females at Muago Hospital, Kampala, Uganda. *African Journal of Health Science*. **5**(1):50-54.
- Onyido A.E., Umeanaeto P.U., Irikannu K.C., Ekwunife C.A., Ezeanya L.C., Nwangwu U.C., Ugha C.N. and Obiechina, I.O. (2014). Prevalence of *Trichomonas vaginalis* Among The Rural Women Of Ekwulumili Community Anambra State, Southeastern Nigeria. *Journal of Natural Sciences*. **12**(5):129-134.
- Oyerinde, J. P. O. (1999). *Essentials of tropical medical Parasitology*. University of Lagos Press, Akoka, Lagos, Nigeria pp 60-62.
- Oyewole, I.O., Anyasor, G.N. and Michael Chikezie, E.C. (2010). Prevalence of STI Pathogens in HIV-Infected and Non-Infected Women: Implications for Acquisition and Transmission of HIV in Nigeria. *Asian Journal of Medical Sciences*. **2**(3): 163-166.
- Pappas, P.G., Kauffman, C.A., Andes, D., Benjamin, D.K., Calandra, T.F., Edwards, J.E., Filler, S.G., Fisher, J.F., Kullberg, B.J., Ostrosky-Zeichner, L., Reboli, A.C., Rex, J.H., Walsh, T.J. and Sobel, J.D. (2009). Clinical Practice Guidelines for the Management of candidiasis: update by the Infectious Diseases Society of America. *Clinical Infectious Diseases*. **48**:503-535.

- Perazzi, B.E., Menghi, C.I., Coppolillo, E.F., Gatta, C., Eliseth, M.C. and De Torres, R.A. (2010). Prevalence and comparison of diagnostic methods for *Trichomonas vaginalis* infection in pregnant women in Argentina. *Korean Journal of Parasitology*. **48**(1):61-5.
- Petrin, D., Delgaty, K., Bhatt, R. and Garber, G. (April 1998). ["Clinical and microbiological aspects of *Trichomonas vaginalis*".](#) *Clinical Microbiology Review*. **11** (2): 300–317.
- Pfaller, M.A. and Diekema, D.J. (2007). Epidemiology of Invasive Candidiasis: a Persistent Public Health Problem. *Virulence*. (2): 119–128.
- Rao, P.S., Devi, S., Shriyan, A., Rajaram, M. and Jagdishchandra, K. (2004). Diagnosis of bacterial vaginosis in a rural setup: Comparison of clinical algorithm, smear scoring and culture by semi quantitative technique. *Indian Journal of Medical Microbiology*. **22** (1):47-50.
- Reed, B.D., Zazove, P., Pierson, C.L., Gorenflo, D.W. and Horrocks, J. (2003). *Candida* transmission and sexual behaviors as risks for a repeat episode of *Candida* vulvovaginitis. *Journal Of Women's Health (Larchmt)*. **12**(10): 979-89.
- Rizvi, N. and Luby, S. (2004). Vaginal discharge: preparations and health Seeking behavior among Nepalese women. *Journal of PMA* .**54**: 620
- Ryan, K.J. and Ray, C.G. (editors) (2004). Sherris Medical Microbiology (4th edition) McGraw Hill Book Company New York. [ISBN 0-8385-8529-9](#).
- Saeabi, E. (2005). *Parasitic diseases in Iran: protozoa*. 4 edition Tehran: Aiij publication. p. 99-100.
- Schwebke, J.R. (2002) Update of trichomoniasis. *Sexually Transmitted Infections*. **78**: 378-379.
- Schwebke, J. R. and Burgess, D. (2004). "Trichomoniasis". *Clinical Journal of Microbiology Reviews*. **17** (4): 794–803.
- Schwebke, J.R. and Desmond, R.A. (2010). A randomized controlled trial of partner notification methods for prevention of trichomoniasis in women. *Sexually Transmitted Diseases*. **37**(6):392–6.
- Shutter, J., Bell, D., Graham, D., Holbrook, K.A. and Bellin, E.Y. (1998). Rates of and risk factors for trichomoniasis among pregnant in mates in New York City. *Journal of Sexually Transmitted Diseases*. **25**: 303-307.
- Silva, S., Negri, M., Henriques, M., Oliveira, R., Williams, D. W. & Azeredo, J. (2011). Adherence and biofilm formation of ~~non-Candida~~*non-Candida albicans* *Candida* species. *Trends in Microbiology* **19**: 241–247.
- Singh, S. I. (2003). Treatment of vulvovaginal candidiasis. *Clinical Review*. CPI/RPC. **136**(9): 2630.
- Smith, D.A. and Ramos, N. (2010) Trichomoniasis: Website: emedicine.medicape.com (update).
- Sobel, J.D. (1997). Vaginitis. *New England Journal of Medicine*. **337**:1896-1903.

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- Sobel, J.D. (2005). What is new in Bacterial virginals and Trichomoniasis? *Infection Diseases clinics of North America* **19** (2): 387-406
- Sobel, J. D., Kauffman, C. A., McKinsey, D., Zervos, M., Vazquez, J. A., Karchmer, A. W., Lee, J., Thomas, C. and Panzer, H. (2000). Candiduria: a randomized, double-blind study of treatment with fluconazole and placebo. *Journal of Clinical Infectious Diseases*. **30**:19–24.
- Soper, D. (2004). "Trichomoniasis: under control or under controlled?". *American Journal of Obstetrics and Gynecology* **190** (1): 281–299.
- Sullivan, D., Henman, M. and Moran, G. (1996). Molecular genetic approaches to identification, epidemiology and taxonomy of non-*albicans* *Candida* species. *Journal of Medical Microbiology*. **44**:399-408.
- Swygard, H., Seña, A.C., Hobbs, M.M. and Cohen, M.S. (2004). "Trichomoniasis: clinical manifestations, diagnosis and management". *Journal Of Sexual Transmitted Infections*. **80** (2): 91–5.
- Tanyüksel, M., Gün, H. and Doganci, L. (1996). Prevalence of *Trichomonas vaginalis* in prostitutes in Turkey. *Central European Journal of Public Health*. **4**: 96-97.
- Thapa, D. M., Singh, S. and Singh, A. (1999). HIV infection and sexually transmitted diseases in a referral STD Centre in South India. *Sexual Transmission Infection* **75**: 191-193.
- The World Gazetteer (2007). Archived from the original on 2013-02-09. Retrieved 2007-02-20.
- Thomas C. Q. and King, K. H., Kenneth, S. Warren and Adel A.F. (1985). Trichomoniasis: In *Tropical and Geographical medicine*. (ed). McGraw Hill Book Company New York. 335-340pp.
- Thomson, J. L. Soper, D. and Gilbert, S. M. (1989) *Trichomonas vaginalis*. *Obstetrics and Gynaecological Journal of Clinical North American* **16**: 531-540.
- Tortorano, A. M., Kibbler, C., Peman, J., Bernhardt, H., Klingspor, L. and Grillot, R. (2006). Candidaemia in Europe: epidemiology and resistance. *International Journal of Antimicrobial Agents*. **27**: 359–366.
- Tyadal, S.P., Zaaijamann, J.D. and Kent, H.L. (1992). An unusual vaginal foreign body. *African Medical Journal*. **61**(33): 108-110.
- Ulogu, I.O., Obiajuru, I.O.C., and Ekejindu, I.M. (2007). Trichomoniasis among women in Nnewi Nigeria. *Nigerian Journal of Parasitology*. **28**(1): PP. 7-10.
- Uneke, C.J., Ugwuonu, C.D.C., Ali, E. and Ali, M. (2006). *Trichomonas vaginalis* infections among pregnant women in South Eastern Nigeria: The public health significance. *The International Journal of Gynecology and Obstetrics*. **6**(1): 17-21.
- Usang, O., Abia-Basse, L., Inyang-etoh, P., Udoh, S., Ani, F. and Archibong, E. (2009). *Trichomonas vaginalis* Infection among Pregnant women in Calabar Cross River state, Nigeria. *The Internet Journal of Gynaecology and Obstetrics*. **14** (2): 1-4.

- Usanga,V.U., Abia-Bassey, L., Inyang-etoh, P.C., Udoh, S., Ani, F. and Archibong, E. (2010). Prevalence Of Sexually Transmitted Diseases In Pregnant And Non-Pregnant Women In Calabar, Cross River State, Nigeria. *The International Journal of Gynecology and Obstetrics*.
- Uzoagulu A.E (2011) *Practical guide to writing research project reports in tertiary institutions*. Cheston Ltd. Enugu. Pp 57-58.
- Verstrepen, K. J. & Klis, F. M. (2006). Flocculation, adhesion and biofilm formation in yeasts. *Molecular Microbiology* 60: 5–15.
- Vidigal, P. G. and Svidzinski, T. I. E. (2009). Yeasts in the urinary and respiratory tracts: is it a fungal infection or not? *Journal of Bras Pathology Medical Laboratory*. **45**: 55–64.
- Vincent, J. L., Rello, J., Marshall, J., Silva, E., Anzueto, A., Martin, C. D., Moreno, R., Lipman, J. and Gomersall, C. (2009). International study of the prevalence and outcomes of infection in intensive care units. *Journal Of African Medical Association*. **302**: 2323–2329.
- Wendel, K.A. and Workowski, K.A. (2007). Trichomoniasis: challenges to appropriate management. *Journal Of Clinical Infectious Diseases*. **44**: 123–129.
- Weston, T.E. and Nicol, C. S. (1963). Natural History of *Trichomonas vaginalis* infection in Males. *British Journal of Venereal Disease*. **39**: 251-257
- Wisplinghoff, H., Seifert, H., Wenzel, R. P. and Edmond, M. B. (2006). Inflammatory response and clinical course of adult patients with nosocomial bloodstream infections caused by *Candida spp*. *Journal of Clinical Microbiological Infections*. **12**: 170–177.
- Workowski, K.A and Berman, S.M. (2006). Sexually transmitted disease treatment and guidelines. Morbidity, Mortality. *Weekly Recommendation Report*. **5**: 1-94
- World Health Organization (2001). Global prevalence and incidence of selected curable sexually transmitted infections.
- World Health Organization (1992). Global Prevalence and Incidence of selected Curable Sexually Transmitted Diseases Overview and Estimates. *WHO Geneva*. P. 45.
- World Medical Association Declaration of Helsinki, WMADH, (2000). Ethical principles for medical research involving human subjects. —Curable Sexually Transmitted Diseases. *Overview and Estimates*.
- World Health Organization (2004) Integrated care for Reproductive Health, Sexually Transmitted and other Reproductive ~~traek~~tract infections. A guide to essential practice Morbidity, Mortality. *Weekly Recommendation Report*, **51**:1-118.
- Xueqiang, F., Yingzhi, Z., Yandfang, Y., Yutao, D. and Huiqing, L. (2007). Prevalence and risk factors of trichomoniasis, bacterial vaginosis, and candidiasis of married women of child-bearing age in rural Shandong. *Journal of Infectious Diseases*. **60**: 257-261.