Prevalence of Urinary Tract Infection among Adult Females in Omu-Aran South-West Nigeria

Ndako James A.[1*], Akinyomade Owolabi[1], Oludolapo Olatinsu[1], Adedapo O. Omolade[2] and Ilochi Ifeanyi[3]

[1]*Department of Microbiology, Landmark University, Omu-Aran, Nigeria.*
[2]*Department of Health Promotion and Education, Faculty of Public Health, University of Ibadan, Nigeria.*
[3]*Department of Medical Laboratory Services, Landmark University Medical Center, Landmark University, Omu-Aran, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: Urinary tract infection is caused by the presence and replication of microorganisms in the urinary tract. Urinary tract infection is a major health problem among females especially among pregnant women and this is caused by the physiological makeup of the female urinary tract.
Objective: This study was designed to assess the epidemiology of UTIs present amidst pregnant women and females residing in the Omu-Aran community.
Materials and Methods: A total of 100 individuals were involved of which 50 were pregnant women while the remaining 50 were non-pregnant females. Semi-structured questionnaires were distributed to all participants to obtain their data. Samples of urine (early morning midstream) were collected in universal bottles from participants. The urine specimens were cultured on four different agar plates which were; cystein lactose electrolyte deficient agar, blood agar, MacConkey agar and nutrient agar for significant bacteria growth. Microscopic and macroscopic examination was also carried out on the samples for possible detection of infections.

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*Corresponding author: Email: ndako.james@lmu.edu.ng;

Results: The result of the culture showed a significant bacterial growth of 77% and 23% of the samples collected showed no significant bacterial growth. Bacteria such as *Escherichia coli, Klebsiella pneumoniae, Staphylococcus* spp.*, Proteus species, Pseudomonas aeruginosa* and *Candida albicans were isolated.* With *Staphylococcus aureus* predominantly present and observed as the causative factor for (45.4%) occurrence of UTIs, closely followed by *Staphylococcus saprophyticus* (13.0%), *Escherichia coli* (13.0%), *Klebsiella pneumoniae* (9.1%) *Proteus species* (9.1%), *Staphylococcus epidermidis* (7.8%) and *Pseudomonas aeruginosa* (1.3%). However the only fungi isolated was *Candida albicans showing (*1.3%) prevalence, Candida is the most common cause of fungal infections in humans.
Conclusion: Results obtained in this work showed a high prevalence of Urinary tract infection at our study location. A prompt enlightenment campaign and need for periodic check among females is highly advocated to reduce or out rightly eliminate the spread of common uropathogens in circulation.

1. INTRODUCTION

The major bacteria-caused infections in humans are urinary tract infections. The incidence and the growth of pathogenic organisms in the urinary tract results in urinary tract infections [1]. Reports indicate that 150 million individuals are diagnosed with urinary tract infections annually thereby placing urinary tract infection (UTI) in the classification of uncomplicated and complicated urinary tract infections (UTIs). Abnormalities caused by UTIs can be due to the presence of a multi-drug resistant infectious organism or a catheter dwelling in the infected individual and this causes an impediment in the flow of urine.

The occurrence of UTIs vary with age, presence of genitourinary complications and sexual practices [2]. Bacteriuria in healthy women is often increased with age from about 1% of female between 5-14 years of age to 20% in women of aged 80 [3].

Urinary tract infections are capable of causing three basic infections namely urethritis known as the inflammation of the urethra, cystitis defined as the inflammation of the bladder and pyelonephritis, inflammation of the kidney [4]. UTIs are prevalent among all age groups and gender but there is a higher level of susceptibility in women, majorly pregnant women due to the fairly short urethra in women which causes a relatively easy upward movement of organisms into the bladder [5]. Pregnancy is also a considerable factor responsible for an increased susceptibility of UTIs in women and this is as a reason of the effect of the pressure placed on the ureter by the gravid uterus causing a stable urine flow. Humoral and immunological changes associated with pregnancy are also likely factors alongside several other factors such as illiteracy, poor hygiene, and unsafe sexual practices.

This study is aimed at estimating the rate at which pregnant women and females are infected with UTIs, identification and isolation of UTI-causing organisms and antimicrobial susceptibility of isolates gotten from the study population.

2. MATERIALS AND METHODS

2.1 Sample Collection

One-hundred (100) midstream urine samples were obtained from our study subjects, 50 were collected from pregnant women with another 50 samples from other Non-Pregnant female residents of the community. The samples were placed in a sterile screw-capped universal container and properly labeled before transport to the laboratory for immediate analysis. Structured questionnaires were administered to obtain relevant information from the volunteer subjects.

2.2 Sample Processing

Under appropriate aseptic conditions, the obtained samples were microscopically examined for appearance and afterwards, cultured on blood agar, nutrient agar, MacConkey agar, CLED. A urine microscopy examination was carried out thereafter. The samples were observed for physical characteristics such as color and transparency.

2.3 Isolation and Identification

Inoculation of the samples on blood agar, nutrient agar, MacConkey agar and Cystine Lactose Electrolyte Deficient - agar (CLED) was performed and the samples were placed in the incubator for 24 hrs at 37°C. Afterwards, gram staining was done followed by biochemical identification procedures using catalase,

coagulase, indole, and citrate utilization, oxidase and urease tests for the proper identification of obtained isolates. *Candida* sp. was isolated according to the method of Lokhart [6].

2.4 Antimicrobial Susceptibility Testing

Antibiotic susceptibility testing was done on the isolates employing the agar diffusion disc procedure (Bauer et al., 1966). Relevant multidiscs containing the correct antibiotics with their corresponding minimum inhibitory concentrations (MICs) were used and placed at room temperature for an hour. The inhibition zones were measured and recorded according to Clinical and Laboratory Standards Institute (CLSI) standards.

3. RESULTS

One hundred (100) females were involved in this study. The rate of samples that yielded positive growth of uropathogen was 77%, while 55% of the positive samples were obtained from the pregnant women. A total of seven uropathogen isolated from the pregnant women includes; *Staphylococcus aureus* (25.9%), *Escherichia coli* (9.1%), *Staphylococcus saprophyticus* (7.8%), *Proteus mirabilis* (3.9%), *Klebsiella oxytoca* (3.9%), *Staphylococcus epidermidis* (2.6%) and *Pseudomonas aeruginosa* (1.3%).

45% of the samples that tested positive were obtained from the non- pregnant women giving a total of eight uropathogen isolated as follows; *Staphylococcus aureus* (19.5%), *Staphylococcus saprophyticus* (5.2%), *Staphylococcus epidermidis* (5.2%), *Klebsiella pneumoniae*

(5.2%), *Escherichia coli* (3.9%), *Proteus mirabilis* (3.9%), *Proteus vulgaris* (1.3%) and *Candida albicans* (1.3%).

A higher level of positive result in the urine microscopy and culture conducted were detected among pregnant women compared to the non-pregnant women. Fig. 1a depicts the study population based on their age distribution. Educational distribution of the study population was also considered and these include: those without formal education, those with primary education, those with secondary education and those with tertiary institution as shown in Fig. 1b.

Table 1a. Age distribution of study population

Age	Pregnant women	Non pregnant women	Total
15-20	5	11	16
21-25	12	14	26
26-30	20	16	36
31-35	10	3	13
36-40	3	6	9
Total	50	50	100

Table 1b. Educational distribution of study population

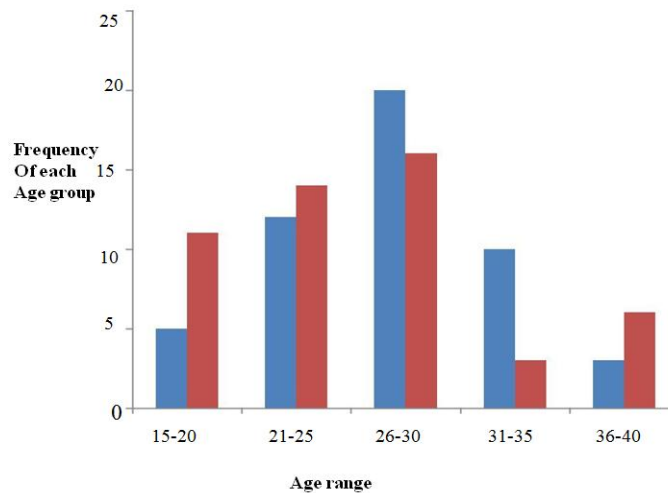| Educational status	Pregnant women	Non-pregnant women	Total
None	6	3	9
Primary school	5	4	9
Secondary school	16	19	35
Tertiary institutio	23	24	47
Total	50	50	100

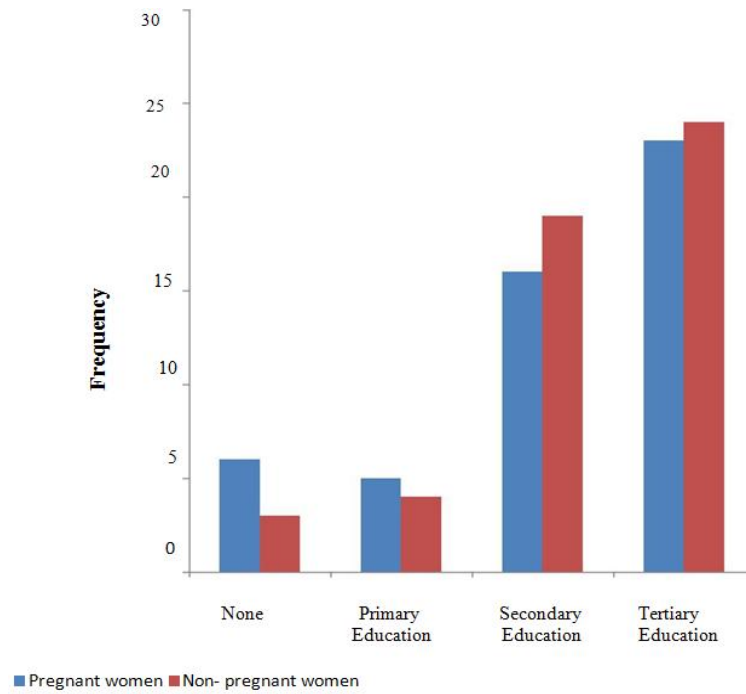**Fig. 1a. Age distribution of the study population**

Fig. 1b. Educational level of subjects recruited for the study

Table 2. Distribution of study population based on clinical history

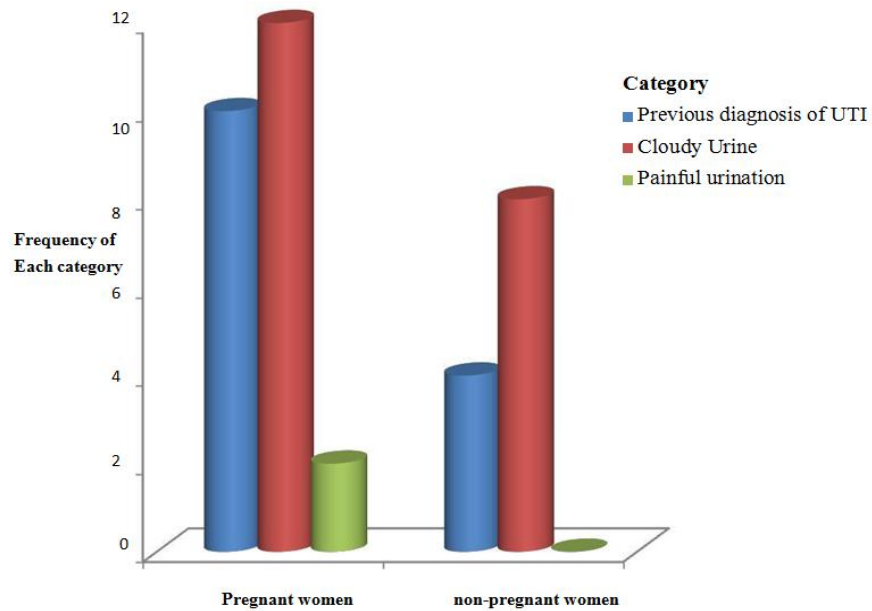| Clinical history	Pregnant women	Non-pregnant women	Total
Previous diagnosis of UTIs	10	4	14
Cloudy Urine	12	8	20
Pain during urination	2	-	2
Total	24	12	36

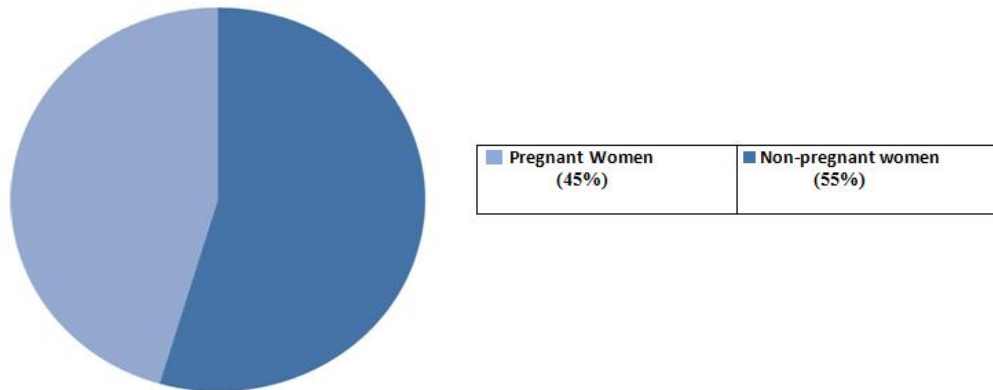**Fig. 2. Distribution of study population based on clinical history**

Fig. 3. Comparative prevalence of UTI among pregnant women and non-pregnant women

Table 3. Organism isolated from the study population

Organism isolated	Total number (n=77%)
Staphylococcus aureus	35(45.4)
Staphylococcus saprophyticus	10(13.0)
Staphylococcus epidermidis	6(7.8)
Proteus mirabilis	6(7.8)
Escherichia coli	10(13.0)
Klebsiella spp.	7(9.1)
Pseudomonas aeruginosa	1(1.3)
Proteus vulgaris	1(1.3)
Candida albicans	1(1.3)

Isolated organism in relation to their frequency among pregnant women and non-pregnant women

Organism isolated	Pregnant women (%)	Non-pregnant women (%)	Total (n=77)
Staphylococcus aureus	20(25.9)	15(19.5)	35
Staphylococcus saprophyticus	6(7.8)	4(5.2)	10
Staphylococcus epidermidis	2(2.6)	4(5.2)	6
Proteus mirabilis	3(3.9)	3(3.9)	6
Proteus vulgaris	-	1(1.3)	1
Escherichia coli	7(9.1)	3(3.9)	10
Klebsiella oxytoca	3(3.9)	-	3
Klebsiella pneumonia	-	4(5.2)	4
Pseudomonas aeruginosa	1(1.3)	-	1
Candida albicans	-	1(1.3)	1

Key: Values in parentheses = percentage of each isolated organism

4. DISCUSSION

Urinary Tract infections (UTIs) is a major infection affecting humans irrespective of their age or gender [7] From the study, a prevalence rate of 77% was recorded and the major uropathogens isolated are shown on Fig. 4.

The prevalence of *Staphylococcus* spp and *Escherichia coli* as the leading uropathogen is in agreement with a previous research carried out by Otajevwo and Eriagbor [8]. This observation is similar to the report of other authors who affirms that *Escherichia coli* is the leading uropathogen followed by *Staphylococcus spp.* 42(54.5%) of the isolated uropathogen were obtained from pregnant women, while 35(45.5%) of the isolated uropathogen were obtained from other female group in the study population. The result obtained from this research is showed a high occurrence of 71.3%, 39.69%, 77.3%, 77.4% and 86% as reported by several authors [8-11] respectively.
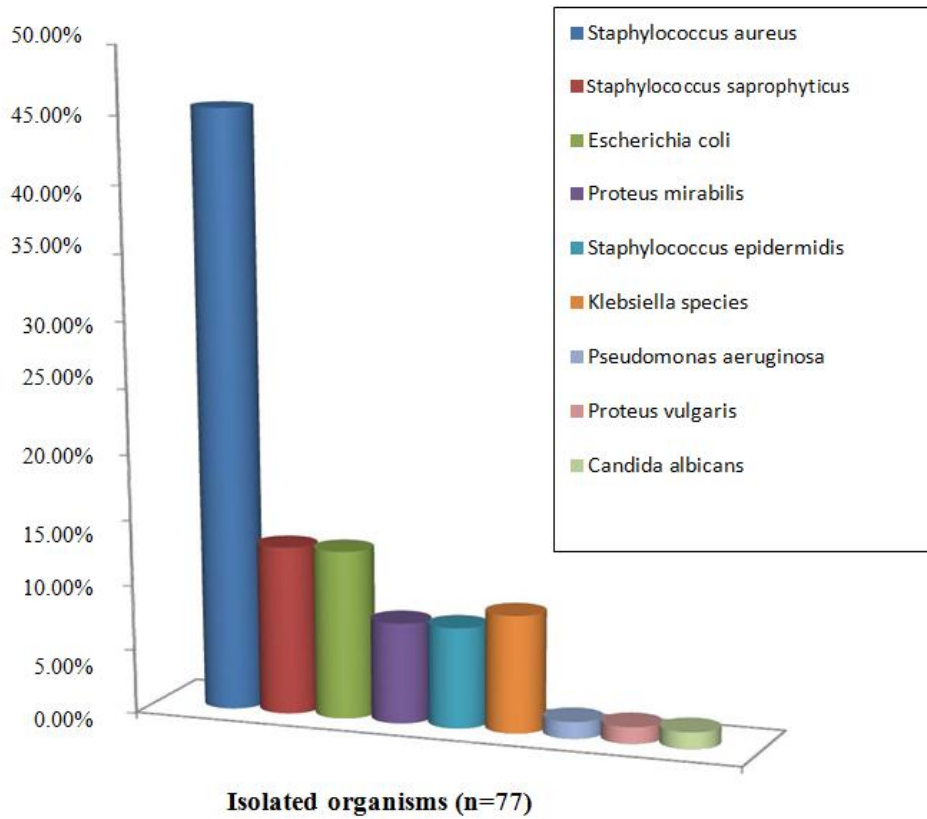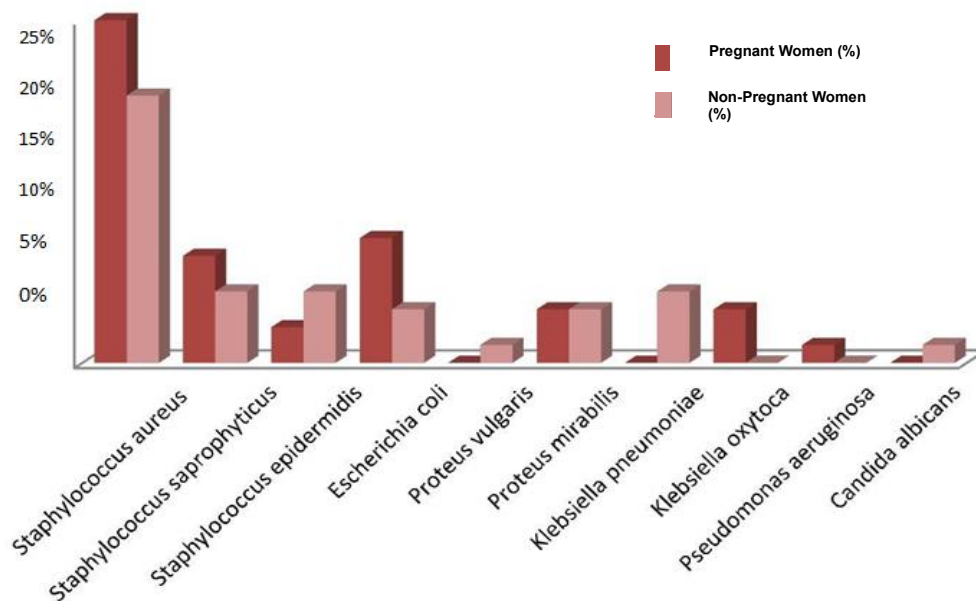
Fig. 4. Organisms isolated from the study population

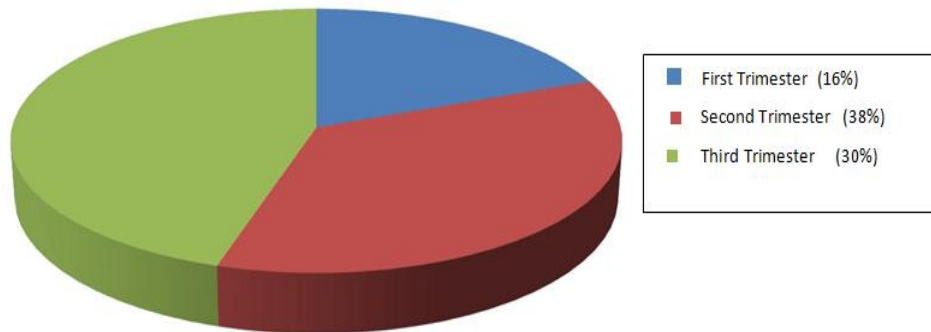**Fig. 5. Showing the percentage of organisms isolated from pregnant and non-pregnant women**

Fig. 6. Prevalence of UTI among pregnant women based on trimesters of pregnancy

Table 4. Microbial identification table

	S. aureus	*E. coli*	*S. saprophyticus*	*P. aeruginosa*	*P. mirabilis*	*P. vulgaris*	*Kleb*
Gram (rxn)	+	-	+	-	-	-	-
Morph	Cocci	Rod	Cocci	Rod	Rod	Rod	Rod
Arrang	clusters	Single	Clusters	Single	Single	Single	Single
Pigment	[-]	[-]	[-]	Green/blue	[-]	[-]	[-]
Motility	[-]	+	-	+	+	+	[-]
Catalase	+	+	+	+	+	+	+
Coagulase	+	-	-	-	-	-	-
Indole	[-]	+	[-]	-	-	+	-
Citrate	[-]	-	[-]	+	+	-	+
Urease	[-]	-	[-]	+	+	+	+
Sucrose	+	-	+	+	+	+	+
Glucose	+	+	+	+	+	+	+
Lactose	+	+	+	-	-	+	+
Mannitol	+	+	+	-	-	-	+

Key: [-] =Not applicable, +ve=positive reaction, -ve=negative reaction, rxn=reaction

Table 5. Susceptibility profile of isolated organism after 24 hours of incubation

Isolated	Selected antibiotics used									
Uropathogen	ERY	STR	CHL	CPR	AUG	GEN	NIT	OFL	NAL	NOV
Staphylococcus aureus	+	+	+	+	-	+	[-]	+	[-]	+
Staphylococcus saprophyticus				+	+		+		[-]	-
Escherichia coli	[-]	[-]	+	+	+	+	+	+	+	[-]
Klebsiella sp	[-]	[-]	-	+	+	+	+	-	-	[-]
Pseudomonas aeruginosa	+	+	+	+	-	+	+	+	+	[-]
Proteus sp	[-]	[-]	-	+	-	-	+	+	-	[-]

Key: ERY = Erythromycin, STR = Streptomycin, CHL = Chloranphenicol, CPR = Ciprofloxacin; AUG = Augmentin, GEN = Gentamycin, NIT = Nitrofurantoin, OFL = Ofloxacin, NAL = Nalid xic acid, NOV = Novobiocin

Results from this study revealed that 42 out of 50 pregnant women screened recorded bacterial growth of uropathogen giving a prevalence of 84% among pregnant the women in the study population. The dominant pathogens isolated are shown on Table 5 and Fig. 5. This is in concordance with research carried out by Obiogbolu et al. [12]. These studies reported an increased incidence rate of 58%, 66%, 47.5%, 30-60% and 54% respectively.

Similar studies conducted in Asia showed that a prevalence of 8.8% was recorded among urology patients [13] and this contrasts a 37% rate recorded for UTI prevalence in Mexico by Alfredo et al. [14]. The increase in UTIs observed in this research could be as a result of poor environmental and personal sanitation, low socio-economic standing, among pregnant women in the study population as well as lack of good housing and drainage system observed among

the study population [15]. The proximity of the female urethra to the anus, which may likely enhance the movement of bacteria from the rectum to the urethra where they cause infection [16].

Hormonal changes observed during pregnancy are another important cause of high prevalence of UTIs among pregnant women. These hormonal changes bring about the reduction of the ureteric muscular tone and this brings about powered pressure from the gravid uterus and lead to stability in urine flow. Urinary stasis enhances the growing of pathogenic bacteria in urine because it is a rich culture media [17]. As a result of these, women in their second and third trimester has a higher incidence of UTIs compared to women in their first trimester, this observation is consistent with the research conducted by Okonko et al. [5] who similarly observed an increased prevalence of UTIs in the second and third trimester of pregnancy, this result also agrees with the work of Okonko et al. [5].

Antibiotics susceptibility testing was performed on all uropathogens isolated except *Candida albicans*. A total of ten antibiotics were used these include; Erythromycin, Streptomycin, Chloranphenicol, Ciprofloxacin, Augmentin, Gentamycin, Nalidixic acid, Nitrofurantoin, Ofloxacin and Novobiocin. The organisms were observed to be highly sensitive to Nitrofurantoin closely followed by Nalidixic acid and Ofloxacin.

This susceptibility test result obtained in this work is consistent with the observations of several authors [18,19] in a similar work conducted among UTI patients.

5. CONCLUSION

The prevalence rate of urinary tract infections obtained from this research is of major concern as this implies the degree of health threat posed to females in our area of study. Consequently, the need to put up measures at curtailing further complications from UTI and urgency at controlling further spread of the infection in the community is given prompt attention.

Similarly, creation of awareness on the infection and adequate enlightenment protocols be established for the populace. Policy makers are also urged to improve on the provision of facilities and services rendered to efficiently prevent and treat pregnant women, this also defines the importance of routine screening and the need to

ensure that accurate laboratory diagnosis is carried out on patients alongside administration of proper antimicrobial agents due to the asymptomatic and symptomatic nature of urinary tract infections in most cases.

This process is to aid the timely identification of asymptomatic urinary tract infections that may eventually develop into symptomatic UTIs resulting in possible renal damage among the study population.

Health authorizes are hereby encouraged to ensure greater emphasis on the personal sanitation of every pregnant woman during the antenatal care visit, particularly among pregnant women of low socio-economic status.

CONSENT

Following international standard; informed and written participant consent has been collected and preserved by the authors.

ETHICAL APPROVAL

The study was permitted by the Landmark University Medical center and a letter of permission was obtained from the Local Government Department of Health services ethical committee in Omu-Aran community.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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