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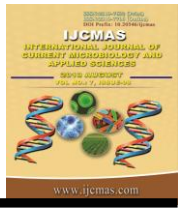

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Bacterial Pathogens Associated With Urinary Tract Infections among Rural Women in Doma, Nasarawa State, Nigeria

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A B S T R A C T

Drug resistance in bacterial pathogen is an evolving problem requiring monitoring. The study aims at determining the prevalence of bacterial pathogens associated with urinary tract infections in rural women. Urine samples (320) were collected from women in Doma Local Government Area, Nasarawa State and bacteria isolated from the samples. Isolates were identified and serotyping carried out. Antibiogram profile of the isolates was subsequently carried out. *Escherichia coli* was the most isolated species with $238x10^5$cfu/ml, while *Pseudomonas aeruginosa* ($12.9x10^5$cfu/ml) had the lowest values obtained. Age range 15–24 years had the highest prevalence of significant bacteriuria (22%), followed by 25–34 years with 14% prevalence. Result of the occupation of participants revealed that students and business women had 28% and 15% prevalence of significant bacteriuria respectively. Enterohemorrhagic *E. coli* 0157 with 8 serotypes, had the highest prevalence of 36.4%, while *E. coli* strain 015 had one serotype with a prevalence of 4.55%. *Pseudomonas aeruginosa* was the most resistant isolate resisting gentamycin, streptomycin, nalidixic acid, and cotrimoxazole completely at 100% resistance. The study concludes that *E. coli* were the major pathogens isolated from urine, and it is highly resistant to commonly prescribed drugs.

Introduction

Urinary tract infection (UTI) is frequently occurring infection in women when compared with men, though in men the symptoms are more severe and protracted (Abdulhadi *et al.*, 2008). Urinary tract includes kidneys, ureter, bladder, and urethra. Compromise of the organs could lead to kidney infections, urethritis, cystitis, and pyelonephritis (Farajnia, 2009). It is common for women to report an episode of urinary tract infection at one time or another, while about 25% of them have recurrences (Fihn, 2003; Foxman, 2000). Infections of the urinary tract are caused by pathogens which colonize the genital tract and express virulence that allow attachment to the mucosa of the urethra. Ahmed (2008) and Davis (2003) reported that while poor hygiene, low socio-economic status, and malnutrition affect people in rural setting; the infections (UTIs) are common in both community and hospital settings UTI increases disease burden on community thus, an important source of morbidity in community (Frank 2013).

While the prevalence of bacteria in the urine varies, *Escherichia coli* has been implicated as the most common cause of infection followed by *Proteus mirabilis* and *Klebsiella pneumonia* (Schmiemann *et al.,* 2010; Naber, 2008). Cystitis is a lower urinary tract infection with symptoms such as dysuria. Compromised immune systems, catheter use, renal transplant, pregnancy, frequent sexual activities are risk factors (Naber, 2008; Warren, 1999). Reports has shown that symptomatic and asymptomatic subjects could have at least 10^3 organisms per ml in their urine which is the evidence sought by the Infectious Disease Society of America (Hooton *et al.,* 2010). Contamination could be from fecal sources and frequent and wild sexual activities As a result of the challenge experience in the diagnosis of the infections of the urinary tract, plus errors reading which could mislead clinician, patients are treated based on symptoms alone (Giesen *et al.,* 2010; Schmiemann *et al.,* 2010). Lately, microscopy to check leucocytes and urine culture to check bacteria are respectively carried out to obtain better treatment. This study was conducted to ascertain the prevalence and to characterize major bacterial pathogens associated with urinary tract infection among rural woman in Doma community, Nasarawa State.

Materials and Methods

Study area

The study was carried out in Doma town, Doma Local Government Area, Nasarawa State, Nigeria. It is located between latitude 8° 24' 3.09" N and longitude of 8° 21' 29.28" E respectively.

Ethical clearance

Ethical clearance for authorization to collect samples, process them, maintain integrity, and maintain privacy of the subjects was obtained from the State Ministry of Health, Nasarawa State, Nigeria.

Sample population

A total of 320 urine samples were collected from rural women who participated in the study. Forty samples were collected weekly for a period of eight weeks.

Sample collection

Women were educated and guided on how to collect a clean catch mid streams urine after which sterile screw-capped universal container were given to them to produce the urine samples.

The samples were transported in a cold chilled container to the laboratory for processing within 6 h.

Isolation and determination of total bacterial count

The method of Cheesbrough (2002) was used to determine the total bacterial count of each sample. Dilutions of urine samples in sterile distilled water were spread plated on agar surfaces of Cystein Lactose Electrolyte Deficient (CLED) media, and incubated at 37 ^{o}C for 24 h, and viable colonies counted. Only samples counts of at least 10^4 cfu/ml was considered to have significant bacteriuria and hence sorted for further analysis.

Identification of bacterial isolates

After morphological characterization of the bacterial isolates, Gram staining reaction was carried out and the following tests conducted: coagulase, citrate utilization, oxidase, and catalase, urease, indole formation, and sugar fermentation (Cheesbrough, 2010; Ochei and Kolhatkar, 2008; Bello, 2002; Atlas *et al.,* 1995).

Serotyping

Serotyping was done using slide agglutination method as described by Cheesbrough (2010). Antisera potency was determined by mixing the antisera (approx. 20 µL) with a drop of distilled water on the slide and the presence of agglutination within 60 s indicate that it should not be use whereas the absence of agglutination means that the antisera was potent and fit for use. Small drop of antisera (approx. 20 µL) was added on a glass slide and mix it with the *Escherichia coli* pure culture. Then the slide was tilted for 60 s. A positive reaction is seen as a visible agglutination in a clear fluid, whereas no agglutination signifies negative result.

Antimicrobial sensitivity testing (Kirby-Bauer method)

The susceptibility of the isolated organisms to selected antibiotics used to treat uropathogens was tested using Kirby-Bauer Method. Sterile Mueller-Hinton agar plates were prepared and inoculated with the different identified isolates per plate, after which prepared antibiotic discs (Ofloxacin – 10 mcg, Pefloxacin – 10 mcg, Augmentin – 30 mcg, Gentamycin – 10 mcg, Septromycin – 30 mcg, Ceporex – 10 mcg, Nalidixic acid – 30 mcg, Cotrimoxazole – 30 mcg, and Ampicillin – 30 mcg) were placed on the inoculated plates. Various antibiotic discs were placed on the surface of the agar medium by gently pressing using a sterile forceps on the top of the discs (for better contact and effective diffusion of the antibiotics into the medium). The plates were incubated in an inverted position for 24 hours at 37 ^{0}C (CLSI, 2012).

Determination of Multiple Antibiotics Resistance (MAR) Index

The MAR Index was determined according to the method of Krumperman (1983) and Paul *et al.*, (1997).

$$\text{MAR Index} = \frac{\text{No. of antibiotics to which isolate is resistant}}{\text{Total no. of antibiotics tested}}$$

Statistical Analysis

The data was analyzed using statistical package for social sciences (SPSS) software and

P values was calculated using Chi–square to identify statistical significant between the distribution of bacterial pathogens isolated form Doma women in Nasarawa State.

Results and Discussion

Bacterial count in urine samples

Total cell count of microorganisms according to weekly collection of urine showed *Escherichia coli* recorded

The highest cell count in week 2 (47.7+33.0) and the least cell count in week 8 (18.8+16.9) (Table 1).

Staphylococcus aureus recorded the highest cell count in week 3 (31.1+13.30) and the least cell count in week 6 (5.9+ 3.4) though the bacteria growth recorded zero cell count in week 7 and 8 respectively,

Proteus mirabilis recorded the highest cell count in week 7 (10.2+2.6), and the least cell count was in week 4 (9+4.2).

Prevalence of bacterial species in urine samples

The prevalence of the bacterial species isolated from urine samples during the study (Table 2) showed that *Escherichia coli* had the highest value of 43.00%, followed by *Klebsiella pneumoniae* 30.00%, *Staphylococcus aureus* 21.00%, *Pseudomonas aeruginosa,* and *Proteus mirabilis* obtained 3.00% each.

The prevalence of bacterial species according to age, occupation, and toilet used

In Table 3, the highest prevalence of bacteriuria was within the age group of 25-34(26.83). The result showed that lower prevalence was recorded as age increases above ≥ 75years as shown in Table 3. There was no statistically significant difference in occurrence of infection by age grouping. (P>0.05; P=0.051). Prevalence of bacteriuria among the subject according to occupation showed that student with 28 significant bacteriuria was highest, while farmers and civil servants had 5 and 6 respectively.

The result also showed that the prevalence of bacteriuria among the subject according to the various occupations was statistically different. (P>0.5; P=0.0397). Widow and separated women had 7 as the least bactriuria according to their marital status, followed by single ladies with 15, while married women had the highest value of 32 as shown in Table 3.

There was no statistically significant difference in the occurrence of infection base on marital status. (P>0.5; P=0.967). According to toilet use, people who ascribed to using the bush had the least prevalence 10, closely followed by those who use pit toilets 11. Out of the 103 sampled for water system, all of them had bacteria in their urine but only 37 had bacteriuria.

Serotyping of *Escherichia coli*

Escherichia coli as the most prevalent microorganism were serotyped to determine the isolated strains of the organism. Enterohemorrhagic *Escherichia coli* (EHEC) 0157 with 8 serotypes isolated had 36.36% prevalence as the highest, serotypes 075 and 04 had zero prevalence each, and one serotype 015 was obtained at 4.55% prevalence.

Antibiogram profile of bacterial species

The antibiogram profile of the isolated bacteria in Table 4 showed the *Pseudomonas aeruginosa* isolates were the most resistant organismsin the women urine samples with all the isolated strains resisting Gentamycin, streptomycin, nalidixic acid, and cotrimaxazole by 100% inhibition, this was followed by *Proteus mirabilis* that had 100% resistance against ofloxacin, ceporex, and nalidixic acid. Cotrimoxazole was the most successful antibiotic as it completely inhibited the growth of *Proteus mirabilis* (0.0%) and *Staphylococcus aureus* (8.3%).

Resistance indices of the isolates

The result of the multiple antibiotic resistance index (MARI) of the isolated organisms (Table 5) showed that all the isolates of the *E. coli, P. mirabilis, P. aeruginosa,* and *S. aureus* exceeded the standard as they were all resistant to at least two antibiotics, while isolate KP 12, a *Klebsiella pneumonia* isolate was only resistant to one antibiotic (ciprofloxacin).

Bacterial count and prevalence of bacteriuria

Average bacterial count showed that the isolates were capable of developing bacteriuria having exceeded the count of over 100,000 cfu/ml which is the standard. *Escherichia coli, Staphylococcus aureus* and *Klebsiella pneumonia* presented values higher than the standard and so could bring about infections. *Proteus mirabilis* and *Pseudomonas aeruginosa* had average values far lower than the standard. *Pseudomonas aeruginosa* is generally designated as an opportunistic pathogen, and so the immune system of the volunteers were strong and so resisted invasion, while *Proteus mirabilis* which are normal flora of soil could likely not

overcome the defense system of most of the volunteers hence the low values obtained (Durowaiye *et al.,* 2011). The report presented in this study is supported by the work done by Kwon *et al.,* (2015) who proposed that values less than the standard encouraged treatment for non-clinically significant UTIs in patients. Tullus (2016) posited that records showed that 46-49% of women diagnosed with cystitis presented low bacterial count. The author recommended that the treating physician should consider all relevant clinical parameters as such low values could be significant. Al-Asoufi *et al.,* (2017) concluded in their report that the different type of pathogens isolated and their distribution are determined by a mix of factors such as environment, host immunity, social and religious practices, level of awareness, socioeconomic standards, and hygiene.

Isolated and identified bacterial species includes *E. coli*, *P. mirabilis*, *S.*aureus, *P. aeruginosa*, and *K. pneumonia*. These isolates were isolated byOli *et al.,* (2018) Kibret and Abera (2014), Derese *et al.,* (2016), and Anejo *et al.,* (2015) from urine. Prevalence of *E.coli* in the present study was high 70.00%, which agreed with the study by Kibret and Abera (2014) 63.60%, and Oladehinde *et al.,* (2011) 85.00% respectively, but contracted the work of Derese *et al.,* (2016) who obtained 9.00% as prevalence of *E.coli* in urine. *E. coli* had severally being reported as the predominant organism responsible for UTIs (Sibiani, 2010; Okonko *et al.,* 2010; Al-Jiffri *et al.,* 2011; Parveen *et al.,* 2011; El-Sokkary, 2011, Vasudevan, 2014). Al-Asoufi *et al.,* (2017), Fu *et al.,* (2014), Benfield *et al.,* (2007), Berke and Tilton (1986), Bonadio *et al.,* (2004), and Boyko *et al.,* (2005) adduced the prevalence of *E. coli* to its virulence conferred by Type 1 fimbriae, S fimbriae, P fimbriae, afimbrial adhesion, aerobactin, cytotoxic necrotizing factor and hemolysin. *Klebsiella pneumonia* had a prevalence of 49% which was high compared to the study of Derese *et al.,* (2016). Kibret and Abera (2014), and Oladehinde *et al.,* (2011) with values of 3%, 8.5% and 9% respectively. *Pseudomonas aeruginosa* had a prevalence of 6% which agreed with the result presented by Derese *et al.,* (2016), Kibret and Abera (2014), and Oladehinde *et al.,* (2011) with 40%, 6.9%, and 5% respectively. The presence of these bacterial species showed the possible likelihood of multiple infections in symptomatic and asymptomatic subjects. Vasudevan (2014) explained that other bacterial species implicated in UTIs include *Staphylococcus* sp., *Proteus, Klebsiella*, and *Enterococcus*; and cause infection through the formation of biofilms. *Proteus mirabilis* initiates UTI by adhering to the uroepithelial tissue using its fimbriae; it also swim towards the kidney using its peritrichous flagella thus gaining added advantage to initiate infection at the site (Khleifat *et al.,* 2006; Al-Asoufi *et al.,* 2017).*Pseudomonas aeruginosa* and *Klebsiella pneumonia* both initiate invasion using their capsules and subsequently cause infection

Prevalence according to age showed that age group 15-24 years had the highest prevalence of positive samples with significant bacteriuria with agreed with the finding by Vasudevan (2014), closely followed by age group of 25-34 years. The significant bacteriuria recorded in the two age groups might be as a result of high sexual activities, early marriage, poor hygiene and ignorance in the community. Sexually active women are in the habit of using spermicides. Sexual intercourse and the use spermicides from report increases the prevalence of UTIs (Fatima and Ishrat, 2006; Mittal and Wing, 2005; Fihn, 2003). Other risk factors are female genital mutilation, wearing tight clothing (WHO, 2016). Report presented by Orrett (2001) agreed with the finding in the study that the age 15-30 years had the highest prevalence. Increasing age led to reducing prevalence as shown in the result.

Table.1 Average cell count of bacteria per milliliter of urine

Isolates	*Escherichia coli*	*Staphylococcus aureus*	*Klebsiella pnuemoniae*	*Proteus mirabilis*	*Pseudomonas aeruginosa*
	Cfu/ml x 10^5				
Week 1	40.0 ± 4.2	10.3 ± 3.9	13.1 ± 3.6	0.00	0.00
Week 2	47.7 ± 33.0	16.7 ± 6.9	14.3 ± 4.0	0.00	6.6 ± 1.9
Week 3	26.4 ± 9.3	31.1 ±13.3	18.8 ± 3.2	0.00	0.00
Week 4	37.0 ± 35.4	9.9 ± 2.7	14.0 ± 4.0	9 ± 4.2	0.00
Week 5	26.6 ± 7.0	7.7 ± 2.7	25.1 ± 7.7	0.00	0.00
Week 6	20.8 ± 14.6	5.9 ± 3.4	6.3 ± 2.8	0.00	4.6 ± 0.5
Week 7	21.2 ±12.6	0.00	0.00	10.2 ± 2.6	0.00
Week 8	18.8 ±16.9	0.00	16.6 ± 7.0	0.00	1.7 ± 0.2

Values are Mean ± SD

Table.2 Isolated bacterial species according to sampling duration

Time	No of samples	*Escherichia coli*	*Staphylococcus aureus*	*Klebsiella pnuemoniae*	*Proteus mirabilis*	*Pseudomonas aeruginosa*
Week 1	40	6 (15.00)	4 (10.00)	5 (12.50)	0 (0.00)	0 (0.00)
Week 2	40	11 (27.05)	5 (12.50)	2 (5.00)	0 (0.00)	2 (5.00)
Week 3	40	12 (30.00)	2 (5.00)	10 (25.00)	0 (0.00)	0 (0.00)
Week 4	40	8 (20.00)	4 (10.00)	6 (15.00)	3 (7.50)	0 (0.00)
Week 5	40	13 (32.05)	6 (15.00)	5 (12.50)	0 (0.00)	0 (0.00)
Week 6	40	6 (15.00)	5 (12.50)	7 (17.50)	0 (0.00)	2 (5.00)
Week 7	40	8 (20.00)	4 (10.00)	6 (15.00)	2 (5.00)	0 (0.00)
Week 8	40	6 (15.00)	4 (10.00)	8 (20.00)	0 (0.00)	2 (5.00)
Total	320	70 (2.88)	34(10.63)	49(15.31)	5 (1.56)	6 (1.89)

N = Total samples analyzed; n = total number of positive samples

Table.3 Prevalence of bacteriuria in urine samples of subjects

	N	n (%)	n^x (%)
Age ranges			
15 -24	78	50	22
25 – 34	82	51	14
35 – 44	52	28	6
45 – 55	55	23	5
55 – 64	27	16	2
65 – 74	15	16	3
≥ 75	10	3	0
Occupation			
Farmers	45	19	5
Business	73	39	15
Civil Servants	38	19	6
Student	105	59	28
House Wives	59	28	9
Marital status			
Single	89	55	15
Married	124	90	32
Widow/separated	107	34	7
Toilet used			
Water system	103	103	37
Pit toilet	145	29	11
Bush	72	32	10

N = Total samples analyzed; n = total number of positive samples; n^x=no of samples with significant bacteriuria

Table.4 Resistance of bacterial species to different antibiotic

Isolates	N	Oflo	Pefl	Cipr	Aug	Gent	Sept	Cep	Nali	Cotr	Amp
E.coli	22	5 (22.7)	6 (27.3)	6 (27.3)	13 (59.1)	11 (50.0)	17 (77.3)	17 (77.3)	8 (36.4)	13 (59.1)	6 (27.3)
Proteus mirabilis	4	4 (100)	0 (0.00)	1 (25.0)	0 (0.0)	0 (0.0)	3 (75.0)	4 (100)	4 (100)	0 (0.0)	1 (25.0)
P. aeruginosa	4	2 (50.0)	1 (25.0)	0 (0.0)	2 (50.0)	4 (100)	4 (100)	3 (75)	4 (100)	4 (100)	2 (50.0)
S.aureus	12	4 (33.3)	7 (58.3)	6 (50.0)	6 (50.0)	7 (58.3)	5 (41.7)	11 (91.7)	12 (100)	1 (8.3)	0 (0.0)
Klebsiella pneumoniae	21	9 (42.9)	6 (28.6)	7 (33.3)	8 (38.1)	10 (47.6)	7 (33.3)	8 (38.1)	17 (81.0)	8 (38.1)	4 (19.1)

N: Number of bacteria isolates; Oflo: Ofloxacin; Pefl: Pefloxacin; Cipr: Ciprofloxacin; Aug: Augmentin; Gent: Gentamycin; Sept: Septromycin; Cep: Ceporex; Nali: Nalidixic acid; Cotr: Cotrimoxazole; Amp: Ampicillin

Table.5 Multiple Antibiotic Resistance Index of the different isolates

Escherichia coli		***Proteus mirabilis***		***Pseudomonas aeruginosa***		***Staphylococcus aureus***		***Klebsiella pneumoniae***	
Isolate	MARI	Isolate	MARI	Isolate	MARI	Isolate	MARI	Isolate	MARI
EC 1	0.3	PR 1	0.4	PA 1	0.4	SA 1	0.4	KP 1	0.4
EC 2	0.7	PR 2	0.6	PA 2	0.8	SA 2	0.4	KP 2	0.2
EC 3	0.3	PR 3	0.3	PA 3	0.6	SA 3	0.5	KP 3	0.5
EC 4	0.2	PR 4	0.4	PA 4	0.7	SA 4	0.5	KP 4	0.5
EC 5	0.4					SA 5	0.4	KP 5	0.5
EC 6	0.3					SA 6	0.3	KP 6	0.3
EC 7	0.8					SA 7	0.6	KP 7	0.3
EC 8	0.4					SA 8	0.5	KP 8	0.4
EC 9	0.6					SA 9	0.7	KP 9	0.6
EC 10	0.2					SA 10	0.5	KP 10	0.4
EC 11	0.3					SA 11	0.6	KP 11	0.4
EC 12	0.7					SA 12	0.5	KP 12	0.1
EC 13	0.5							KP 13	0.4
EC 14	0.5							KP 14	0.4
EC 15	0.6							KP 15	0.5
EC 16	0.4							KP 16	0.6
EC 17	0.5							KP 17	0.5
EC 18	0.4							KP 18	0.3
EC 19	0.5							KP 19	0.4
EC 20	0.3							KP 20	0.3
EC 21	0.3							KP 21	0.3
EC 22	0.6								

EC: *Escherichia coli;* PR: *Proteus mirabilis*; PA: *Pseudomonas aeruginosa;* SA: *Staphylococcus aureus;* KP: *Klebsiella pneumonia;* MARI: Multiple Antibiotics Resistance Index

This might be as a result of decreasing sexual activities, effect of hormone as a result of menopause, while older women with positive significant bacteriuria might result from amount of urine loss, diabetes pyelonephritis (Kent *et al.*, 2014). Saidi *et al.*, (2005) explained that at gestational age, vagina secretion is increased, and progesterone action increases the glucose level in the vagina which subsequently encourage

bacterial proliferation; which is absent in menopausal women hence the reduced prevalence recorded. Prevalence of bacteriuria according to occupation showed student had the highest significant bacteriuria. The result disagreed with the report by Kabugo *et al.,* (2006) who presented self-employed women (53.03%) as the most prevalent class, and Anejo-Okopi *et al.,* (*2*015) who reported unemployed women with 32.0% significant bacteriuria as the most prevalent respectively. Anejo-Okopi *et al.,* (2015) argued that women of reproductive age were more active which supports finding in this study. Early child marriage is common in Northern Nigeria and most of the students are in the marriage class. Civil servants with the lowest prevalence might be as a result of education, awareness, and means of managing their personal hygiene.

Report from the study showed that married women had the highest prevalence which supports the report of Kabugo *et al.,* (2016), and Anejo-Okopi *et al.,* (2015). Married women are involved in sexual activities more as a legal obligation, and in some cases to polygamous husbands, so increasing sexual activities further predisposes married women to more and newer bacterial species and strains. Fecal disposal means showed that women who use the water closet system have higher positive bacteriuria when compared with those who dispose excrete in pit toilet and bush. Disposal of fecal in the water closet by women brought about higher prevalence because of the likelihood of the content of the sewage bowl to spill back into the genital of the woman. Distance between the genitals and the fecal receiving surface is a factor as the farther away the two are from each other the more difficult it is for transmission of pathogens.

One UPEC (uropathogenic *E. coli*) strains 015 (Abe *et al.,* 2008) and EHEC (enterohemorrhagic *E. coli*/strains 8 (0157) and 2 (0157; H7) were obtained. Eleven (50%) of the *E.coli* isolates did not type with the sera used in the study which means other serotypes and isolated microorganisms such as *Proteus mirabili*s, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Staphylococcus aureus* might be responsible for UTIs in the community Blanco *et al.,* (1997). Wiles *et al.,* (2008) and Blanco *et al.,* (1997) reported that (UPEC) possesses virulence factors which help them colonize the peri-urethral area. Result from the study on serotype 015 agreed with earlier work of Shweta *et al.,* (2016) that the UPEC serotype is peculiar to the UTI. *Escherichia coli*; 0157:H7 found in urine in this study agreed with report of study by Mouna (2017). Contamination during defecation, sex, and low immunity are predisposing factors that could lead to the presence of serotype 0157:H7 in the UTI.

Antibiotics commonly prescribed for UTI treatments are cephalosporins, semisynthetic penicillins with beta-lactamase inhibitors, quinolones and sulphur containing drugs. Ofloxacin, ciprofloxacin, pefloxacin, nalidixic acid all belong to the fluoroquinolone group of antibiotics and exert their action by stopping bacteria growth. Resistance noted to the different fluoroquinolones could be attributed to antibiotic abuse, incidence of natural selection in the microorganisms, or poor immunity of the subjects (Martinez, 2009; Livermore and Woodford, 2000). Gentamycin and streptomycin are aminoglycoside antibiotic with broad spectrum of activities. Streptomycin prevents 30S ribosomal subunit from producing protein by causing misreading of t-RNA. Resistance against the antibiotics could also be natural by transformation, and through the acquisition of new DNA or mutation (Rice, 2012). Antibacterial actions of ampicillin and ciporex could be attributed to the activity of

beta-lactamase enzymes present in the bacteria cell wall that deactivates the antibiotics at their beta-lactam rings (Sagar *et al.,* 2017; Chambers *et al.,* 1995; Finch, 1986).

Findings in this study are corroborated by findings by Jafri *et al.,* (2014) who reported that ciprofloxacin could not completely inhibit *E.coli* (87.50% inhibition). The antibiogram of the other Gram negative isolates showed some degree of resistance to the tested drugs. *Pseudomonas aeruginosa* resisted Gentamycin, Cotrimoxazole, and amoxicillin which agreed with the result obtained by Abubakar (2009). Most of the isolates resisted inhibition by ampicillin and gentamycin, while *Staphylococcus aureus* a Gram positive organism resisted inhibition by Nalidixic acid, augmentin and ciprofloxacin which agreed with the findings of Oluremi (2011) and Uwaezuoke and Ogbulie (2006). Resistant activities of *E. coli, P. aeruginosa*, *Klebsiella pneumonia* and *Proteus mirabilis* in this study also agreed with findings by Tamalli *et al.,* (2013). The authors reported that the bacterial species were highly resistant to ampicillin and cotrimoxazole.

Two types of bacterial resistance have been described; chromosomal and plasmid mediated resistance. Antibiotic use kick-start plasmid mediated resistance which can lead to multiple drug resistance. Resistance to the different type of antibiotic in this study might be attributed to inactivating enzymes encoded by gene found in the plasmid which could be transferred between strains (Wang and Archer, 2010). Resistance could also come from bacteria incorporating naked DNA acquired from the environment into its genome (Coffey *et al.,* 1991; Spratt, 1988).

The present study concluded that *Escherichia coli* were the most prevalent bacteria causing UTI among women in Doma community. The study also presented evidences of high level of multi drug resistance in the community. Most of the isolates were not susceptible to more than two different antibiotics (MDRI> 0.2), and the result of the antibiotic sensitivity tests revealed that many of the isolated bacteria have developed resistance to the commonly prescribed antibiotics. It implies that there is need to perform culture and sensitivity tests before antibiotics are prescribed in order to achieve complete therapy. Resistance build-up for bacteria against antibiotics has become a global threat as it impact negatively into increasing cost of managing diseases, formation of super-resistant pathogens, increasing mortalities, and risks to health workers and the community at large. The need to check the onslaught of resistant bacteria cannot be overemphasized, hence the study recommends reduce use and access to antibiotics for therapy and as growth hormones while efforts should be geared at new means of achieving the same positive results produced by antibiotics.

References

Abdulhadi, S.K., Yashua, A.H., and Uba, A. 2008. Organisms causing urinary tract infection in paediatric patients at Murtala Muhammad Specialist Hospital, Kano, Nigeria. *International Journal of Biomedicine and Health Science.* 4: 165-167.

Abe, C. M., Salvador, F. A., Falsetti I. N., *et al.,* 2008. "Uropathogenic *Escherichia coli* (UPEC) strains may carry virulence properties of diarrhoeagenic *E. coli*," FEMS Immunology and Medical Microbiology. 52(3): 397–406.

Abubakar, E.M. 2009. Antimicrobial susceptibility pattern of pathogenic bacteria causing urinary tract infections at the Specialist Hospital, Yola, Adamawa State, Nigeria. Journal of

Clinical Medicine Research, 1(1): 001-008

Ahmed, S.M., and Avasarala, A.K. 2008. Urinary tract infections (UTI) among adolescent girls in rural Karimnagar district, AP - K.A.P. STUDY. *Indian Journal of Preventive and Social Medicine.* 39(1−2): 67–70.

Ali, A., Ali, K., Amjad, A., Khalid, A., Muhamad, A., and Khaled, K. 2017. Bacterial Quality of Urinary Tract Infections in Diabetic and Non Diabetics of the Population of Ma'an Province, Jordan. *Pakistan Journal of Biological Sciences* 20: 179-188. DOI: 10.3923/pjbs.2017.179.188

Al-Jiffri, O., El-Sayed, Z.M.F., and Al-Sharif, F.M. 2011. Urinary tract infection with *Escherichia coli* and antibacterial activity of some plants extracts. *International Journal of Microbiology Research.* 2(1): 1-07.

Anejo-Okopi, J.A., Okojokwu, O.J., Ramyil, S.M., Bakwet, P.B., Okechalu, J., Agada, G., Bassi, P.A., and Adeniyi, S.D. 2015. Bacterial and antibiotic susceptibility pattern of urinary tract infection isolated from asymptomatic and symptomatic diabetic patients attending tertiary hospital in Jos, Nigeria. Trends in Medicine. 17(1):1-5. DOI: 10.15761/TiM.1000108

Atlas, R.M., Williams, J.F., and Huntington, M.K. 1995. *Legionella* contamination of dental-unit waters. *Applied and Environmental Microbiology.* 61: 1208-1213.

Bello, C.S.S. 2002. Laboratory Manual for Students of Medical Microbiology. 2nd Edn., Satohgraphics Press, Jos North, Plateau, pp: 80-85.

Benfield, T., Jensen, J.S., and Nordestgaard, B.G. 2007. Influence of diabetes and hyperglycaemia on infectious disease hospitalisation and outcome. *Diabetologia.* 50: 549-554.

Berke, A., and Tilton, R.C. 1986. Evaluation of rapid coagulase methods for the identification of *Staphylococcus aureus*. *Journal Clinical Microbiology*. 23: 916-919.

Blanco, M., Blanco, J. E., Alonso, M. P., Mora, A., Balsalobre, C., and Muñoa, F. 1997. "Detection of pap, prs & afa adhesin-encoding operons in uropathogenic *E. coli* strains: relationship with expression of adhesions and production of toxin," Research in Microbiology. 148: 745–755.

Bonadio, M., Boldrini, E., Forotti, G., Matteucci, E., Vigna, A., Mori, S., and Giampietro, O. 2004. Asymptomatic bacteriuria in women with diabetes: influence of metabolic control. *Clinical Infectious Diseases.* 38: e41-e45.

Boyko, E.J., Fihn, S.D., Scholes, D., Abraham, L., and Monsey, B. 2005. Risk of urinary tract infection and asymptomatic bacteriuria among diabetic and nondiabetic postmenopausal women. *American Journal of Epidemiology.* 161: 557-564.

Chambers, H. F. *et al.*, 1995. Can penicillins and other beta-lactam antibiotics be used to treat tuberculosis? Antimicrobial Agents and Chemotherapy. 39: 2620–2624, doi:10.1128/aac.39.12.2620.

Cheesbrough, M. 2002. Book Review: Selection of Basic Laboratory Equipment for Laboratories with Limited Resources. Tropical Doctor. 32(3): 190.

Cheesbrough, M. 2006. District Laboratory Practice in Tropical Countries. 2nd Edn., Cambridge University Press, Cambridge, UK., ISBN-13: 9781139449298.

Cheesbrough, M. 2010. District Laboratory Practice in Tropical Countries Part 2, Second Edition update P 322

CLSI 2012. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard, 9th edn, M7- A9. Wayne, PA: Clinical and Laboratory Standards Institute.

Coffey, T.J., Dowson, C.G., Daniels, M. 1991. Horizontal transfer of multiple penicillin-binding protein genes, and capsular biosynthetic genes, in natural populations of *Streptococcus pneumoniae*. Mol Microbiol. 5(9): 2255–2260.

Davis, J., and Stager, C. 2003. Detection of asymptomatic bacteriuria in obstetric patients with a semi-automated urine screen. *American Journal of Obstetrics and Gynecology*. 60(2): 363-369.

Derese, B., Kedir, H., Teklemariam, Z., Weldegebreal, F., and Balakrishnan, S. 2016. Bacterial profile of urinary tract infection and antimicrobial susceptibility pattern among pregnant women attending at antenatal Clinic in Dil Chora Referral Hospital, Dire Dawa, Eastern Ethiopia Ther. Clin. Risk Manag. 12 251-260. doi: 10.2147/TCRM.S99831

Durowaiye, M.T., Onaolapo, J.A., and Oyi, A.R. 2011. Preliminary study on asymptomatic bacteriuria in pregnant women attending antenatal clinics in three hospitals in Kano, a north-west city in Nigeria. *Nigerian Journal of Pharmaceutical Sciences*, 10(2): 15–21

El-Sokkary, M. 2011. Prevalence of Asymptomatic Bacteriuria in Antenatal Women with Preterm Labour at an Egyptian Tertiary Centre. *Journal of American Science.* 7(4): 605-610.

Farajnia, S., Alikhani, M.Y., Ghotaslou, R., Naghili, B., and Nakhlband, A. 2009. Causative agents and antimicrobial susceptibilities of urinary tract infections in the Northwest of Iran. *International Journal of Infectious Diseases*. 13: 140-144.

Fatima, N., and Ishrat, S. 2006. Frequency and risk factors of asymptomatic bacteriuria during pregnancy. *Journal of the College of Physicians and Surgeons Pakistan*. 16(4): 273-275.

Fihn, S.D. 2003. Acute Uncomplicated Urinary Tract Infection in Women. New England Journal of Medicine. 349:259-266. DOI: 10.1056/NEJMcp030027

Fihn, S.D. 2003. Clinical practice. Acute uncomplicated urinary tract infection in women. *New England Journal of Medicine.* 349(3): 259-266.

Finch, R. 1986. Beta-lactam antibiotics and mycobacteria. The Journal of antimicrobial chemotherapy. 18: 6–8.

Foxman, B., Gillespie, B., Koopman, J., Zhang, L., Palin, K., Tallman, P., Marsh, J.V., Spear, S., Sobel, J.D., Marty, M.J., and Marrs, C.F. 2000. Risk factors for second urinary tract infection among college women. *American Journal of Epidemiology.* 151: 1194-1205.

Frank, P. N., Chukwugozim, U. R., Okerentugba, P., and Okonko, A. 2013. HIV-1 and -2 Co-Infections with Multi-Drug Resistant (MDR) Uropathogensise Port Harcourt, Nigeria. *Nature and Science*. 11(11)

Fu, A.Z., Iglay, K., Qiu, Y., Engel, S., Shankar, R., and Brodovicz, K. 2014. Risk characterization for urinary tract infections in subjects with newly diagnosed type 2 diabetes. *Journal of Diabetes and its Complications.* 28: 805-810.

Giesen, L.G.M., Cousins, G., Dimitrov, B.D., van de Laar, F.A., and Fahey, T. 2010. Predicting acute uncomplicated urinary tract infection in women: a systematic review of the diagnostic accuracy of symptoms and signs. BMC Family Practice. 11:78

Jafri, S. A., Qasim, M., Masoud, M. S., Rahman, M., Izhar, M., and Kazmi, S. 2014. Antibiotic resistance of *E. coli* isolates from urine samples of Urinary Tract Infection (UTI) patients in Pakistan. *Bioinformation*, *10*(7), 419–422. http://doi.org/10.6026/97320630010419

Kabugo, D., Kizito, S., Ashok, D.D., Graham, K.A., Nabimba, R., Namunana, S., Kabaka, M.R.., Achan, B., and Naijuka, F.C. 2016. Factors associated with community acquired urinary tract and infection among adults attending assessment centre, Mulago Hospital, Uganda. Afr Health Sci. 16(4):1131-1142. doi: 10.4314/ahs.v16i4.31.

Khleifat, K., Abboud, M., Al-Shamayleh, W., Jiries, A., and Tarawneh, K.A. 2006. Effect of chlorination treatment on gram negative bacterial composition of recycled wastewater. *Pakistani Journal of Biological Science.* 9: 1660-1668.

Kibret, M., and Abera, B. 2014. Prevalence and antibiogram of bacterial isolates from urinary tract infections at Dessie Health Research Laboratory, Ethiopia. Asian Pac J Trop Biomed, 4(2):164-168.

Krumperman, P.H. 1983. Multiple antibiotic resistance indexing *Escherichia coli* to identify risk sources of faecal contamination of foods. *Applied and Environmental Microbiology.* 46: 165-170.

Kwon, S., Jeong, S., and Jeong, Y. S. 2015. Assessment of difference in gene expression profile between embryos of different derivations. *Cellular Reprogramming.* 17(1):49–58.

Livermore, D.M., and Woodford, N. 2000. Carbapenemases: a problem in waiting? Curr Opin Microbiol. 3:489–495.

Martinez, J.L. 2009. The role of natural environments in the evolution of resistance traits in pathogenic bacteria. Pro Roy Soc B. 276: 2521–2530. doi:10.1098/rspb.2009.0320

Mittal, P., and Wing, D.A. 2005. Urinary tract infections in pregnancy. *Clinics in Perinatology.* 32(3): 749-764.

Mouna, A. H. A. 2017. Identification of *E.coli* O157:H7 in Intestinal and Urinary Tract Infection in Samawah City. Journal of Babylon University/Pure and Applied Sciences/ No.(2)/. 25: 455-460

Naber, K.G., Schito, G., Botto, H., Palou, J., and Mazzei, T. 2008. Surveillance study in Europe and Brazil on clinical aspects and Antimicrobial Resistance Epidemiology in Females with Cystitis (ARESC): implications for empiric therapy. European Urologist. 54: 1164-1175

Ochei, J., and Kolhatkar, A. 2008. Medical Laboratory Science: Theory and Practice. Tata McGraw Hill Publishing Co. Ltd., New York, USA, ISBN-13: 978-0074632239, Pages: 1364.

Okonko, I.O., Ijandipe, L.A., Ilusanya, A.O., Donbraye-Emmanuel, O.B., Ejembi, J., *et al.*, 2010. Detection of Urinary Tract Infection (UTI) among pregnant women in Oluyoro Catholic Hospital, Ibadan, South-Western Nigeria. *Malaysian Journal of Microbiology*. 6(1): 16-24.

Oladeinde, B.H., Omoregie, R., Olley, M., and Anunibe, J.A. 2011. Urinary tract infection in a rural community of Nigeria. North Am. J. Med. Sci., 3: 75-77.

Oli, A.N., Akabueze, V.B., Ezeudu, C.E., Eleje, G.U., Ejiofor, O.S., Ezebialu, I.U., Oguejiofor, C.B., Ekejindu, I.M., Emechebe, G.O., and Okeke, K.N. 2018. Bacteriology and Antibiogram of Urinary Tract Infection among Female Patients in a Tertiary Health Facility in South Eastern Nigeria. *The Open Microbiology Journal.* 11: 292-300. DOI: 10.2174/1874285801711010292

Oluremi, B.B., Idowu, A.O., Olaniyi, J.F. 2011. Antibiotic susceptibility of common bacterial pathogens in urinary tract infections in a Teaching Hospital in Southwestern Nigeria. Afr. J. Microbiol. Res. 5(22): 3658 - 3663.

Parveen, S.S., Reddy, S.V., Rama, R.M.V., and Janardhan, R.R. 2011. Uropathogens and their Drug susceptibility patterns among pregnant women in a teaching hospital. *Annals of Biological Research.* 2(5): 516-521.

Paul, S., Bezbarauh, R.L., Roy, M.K., and Ghosh, A.C. 1997. Multiple antibiotic resistance (MAR) index and its reversion in *Pseudomonas aeruginosa*. *Letters in Applied Microbiology.* 24: 169-171.

Rice, L.B. 2012. Mechanisms of Resistance and Clinical Relevance of Resistance to β-Lactams, Glycopeptides, and Fluoroquinolones. Mayo Clin Proc. 87(2): 198–208

Sagar, A., Haleem, N., Mir Bashir, Y., and Ashish, W. 2017. Search for non-lactam inhibitors of mtb β-lactamase led to its open shape in apo state: new concept for antibiotic design. Scientific Reports. 7: 6204. doi: 10.1038/s41598-017-06023-3

Saidi, A., Delaporte. V., Lechevdlier, E. 2005. Urological problems encountered during pregnancy. *Progres En Urologie*. 15:1-5.

Schmiemann, G., Kniehl, E., Gebhardt, K., Matejczyk, M.M., and Hummers-Pradier, E. 2010. The Diagnosis of Urinary Tract Infection A Systematic Review. *Dtsch ADtsch Arztebl International*. 107(21): 361–367.

Shweta, S., Nirmaljit, K., Shalini, M., Preeti, M., Wasim, A., and Charoo, H. 2016. "Serotyping and Antimicrobial Susceptibility Pattern of *Escherichia coli* Isolates from Urinary Tract Infections in Pediatric Population in a Tertiary Care Hospital," Journal of Pathogens, Article ID 2548517, 4 pages, 2016. https://doi.org/10.1155/2016/2548517.

Sibiani, S.A.A. 2010. Asymptomatic Bacteriuria in Pregnant Women in Jeddah, Western Region of Saudi Arabia: Call for Assessment. *Journal of King Abdulaziz University-Science Medical Science*. 17(1): 29-42.

Spratt, B.G. 1988. Hybrid penicillin-binding proteins in penicillin-resistant strains of Neisseria gonorrhoeae. Nature (London). 332: 173–176.

Tamalli, M., Sangar, B., and Alghazal, M.A. 2013. Urinary tract infection during pregnancy at Al-Khoms, Libya. I*nternational Journal of Medicine and Medical Sciences*, 3(5): 455-459.

Tamalli, M., Sangar, B., and Alghazal, M.A. 2013. Urinary tract infection during pregnancy at Al-Khoms, Libya. *International Journal of Medicine and Medical Sciences*. 3(5): 455-459.

Uwaezuoke, J.C., and Ogbulie, N. 2006. Antibiotic sensitivity pattern of urinary tract pathogens in Port-Harcourt, Nigeria. Journal of Applied Sciences and Environmental Management, 10(3): 103-7.

Vasudevan, R. 2014. Urinary Tract Infection: An Overview of the Infection and the Associated Risk Factors. *Journal of Microbiology and Experimentation*. 1(2): 00008. DOI: 10.15406/jmen. 2014.01.00008

Wang, L., Archer, G.L. 2010. Roles of CcrA and CcrB in excision and integration of staphylococcal cassette chromosome mec, a *Staphylococcus aureus* genomic island. J Bacteriol. 192(12): 3204–3212.

Warren, J.W., Abrutyn, E., Hebel, J.R., Johnson, J.R., Schaeffer, A.J., and Stamm, W.E. 1999. Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis

and acute pyelonephritis in women. *Infectious Diseases Society of America (IDSA) Clinical Infectious Diseases.* 29: 745-758.

Wiles, T. J., Kulesus, R. R., and Mulvey, M. A. 2008. "Origins and virulence mechanisms of uropathogenic *Escherichia coli*," Experimental and Molecular Pathology. 85(1): 11–19.

World Health Organization 2016. Health risks of female genital mutilation (FGM). http://www.who.int/reproductivehealth/topics/fgm/health_consequences_fgm/en

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