Science World Journal Vol. 18(No 1) 2023
www.scienceworldjournal.org
ISSN: 1597-6343 (Online), ISSN: 2756-391X (Print)
Published by Faculty of Science, Kaduna State University

Full Length Research Article

PREVALENCE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF *KLEBSIELLA PNEUMONIAE* AND *PSEUDOMONAS AERUGINOSA* AMONG WOMEN WITH URINARY TRACT INFECTIONS ATTENDING ANTENATAL CARE IN KADUNA, NIGERIA

Abdulfatai K. [1], *Sanusi S.B. [2], Usman A. [2], Lawal S.M. [2], Idris H. [2]

[1]Department of Medical Laboratory Science, Faculty of Allied Health Sciences, Kaduna State University, P.M.B 2339, Kaduna, Nigeria
[2]Department of Microbiology, Faculty of Science, Kaduna State University, P.M.B 2339, Kaduna, Nigeria

*Corresponding Author Email Address: sanusishuaibu@gmail.com

ABSTRACT
This study determines the prevalence and antimicrobial susceptibility pattern of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* among women with urinary tract infections attending antenatal care in Barau Dikko Teaching Hospital Kaduna, Nigeria. A total of 230 mid-stream urine samples were collected and the organisms were identified using cultural (MacConkey agar and Cetrimide agar respectively) and biochemical methods. Antibiotics susceptibility test was performed using commercial disc. The overall UTIs prevalence was 22.17% (51/230) among which 14.78% (34/230) were *Klebsiella pneumonia* and 7.39% (17/230) were *Pseudomonas aeruginosa*. *Klebsiella pneumonia* was most sensitive to Augmentin, Ciprofloxacin (100% susceptible to the isolates respectively), and Amoxicillin (88.24%). It was moderately sensitive to chloramphenicol (67.65%), Trimethoprim/Sulfamethoxazole (44.17%), Gentamycin (38.24%) and Pefloxacin (29.24%), while being least sensitive to Sparfloxacin (26.41%), Streptomycin (26.41%) and Ofloxacin (Tarivid) (11.76%). The highest susceptibility of *Pseudomonas aeruginosa* was observed in Amoxicillin (94.12%) followed by Ciprofloxacin (84.35%) and then Augmentin (76.47%), while being least susceptible to Chloramphenicol (41.18%), Sparfloxacin (35.29%), Pefloxacin (23.53%) and Tarivid (14.23%). On the other hand, isolates of *Pseudomonas aeruginosa* obtained from the urine cultures exhibited intermediate susceptibility to Streptomycin (70.59%), Septrin (64.71%), and Gentamycin (58.82%). In conclusion the uropathogens examined were 100% susceptible to Augmentin and Ciprofloxacin for *Klebsiella pneumonia* and Amoxicillin was more sensitive to *Pseudomonas aeruginosa*. Health education among women, especially pregnant mothers, on the risk, transmission and prevention of infection with uropathogens should be embarked upon by relevant authorities. Furthermore, health care personnel should be proactive in taking steps to prevent nosocomial transmission of these pathogens during antenatal visits of expectant mothers.

Keywords: Prevalence, Susceptibility, Pregnant, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*..

INTRODUCTION

Urinary tract infections (UTIs) are caused by the presence and growth of micro-organisms in the urinary tract and are the single common bacterial infection of mankind (Onwuezobe and Orok, 2015). In pregnancy, UTIs may involve the lower urinary tract or bladder. The three clinical manifestations of UTIs in pregnancy are asymptomatic bacteriuria, acute cystitis and pyelonephritis (Oluwafami *et al.,* 2018; Odoki *et al.,* 2019). Antibiotic resistance of urinary tract pathogens has been known to be on the increase worldwide especially to commonly used antimicrobials. Bacteria belonging to the genus *Klebsiella* frequently cause human nosocomial infections in particular, the medically important species, *Klebsiella pneumoniae*, accounts for a significant proportion of hospital-acquired urinary tract infections, pneumonia, septicemias, and soft tissue infections (Onwuezobe and Orok, 2015). The principal pathogenic reservoirs for transmission of *Klebsiella* are the gastrointestinal tract and the hands of hospital personnel. These bacteria tend to cause nosocomial outbreaks because of their ability to spread rapidly in the hospital environment. These organisms have been isolated from abscesses, blood, catheter tips, lungs, peritoneal fluid, sputum, and throat cultures (Onwuezobe and Orok, 2015). *Klebsiella pneumoniae* is an important nosocomial pathogen that has the potential to cause severe morbidity and mortality. *Pseudomonas aeruginosa* is ubiquitous pathogen prevalent in hospital environments. It can cause severe nosocomial infections, particularly among immunocompromised patients. People with respiratory, gastro-intestinal, urinary tract, and wound infections as well as burn victims, individuals with cancer, and patients hospitalized in intensive care units are affected by *Pseudomonas. aeruginosa* mostly due to nosocomial spread and cross contamination (Aernan and Umeh, 2016). *Pseudomonas. aeruginosa* accounts for 10% of all hospital acquired infections, a site specific prevalence which may vary from one unit to another.
Pseudomonas aeruginosa can develop resistance to antibiotics either through the acquisition of resistance genes on mobile genetic elements (i.e., plasmids) or through mutational processes that alter the expression and/or function of chromosomally encoded mechanisms. Both strategies for developing drug resistance can severely limit the therapeutic options for treatment of serious infections. (Ghaima *et al*., 2018; Rajivghandhi *et al.,* 2018; Behbani *et al*., 2019; Dabir *et al*., 2020). This study determine the prevalence and antimicrobial susceptililty pattern of *Klebsiella pneumoniae* and *Pseudomonas aeruginos a*among women with urinary tract infections attending antenatal care in Barau Dikko Teaching Hospital Kaduna, Nigeria.

Science World Journal Vol. 18(No 1) 2023
www.scienceworldjournal.org
ISSN: 1597-6343 (Online), ISSN: 2756-391X (Print)
Published by Faculty of Science, Kaduna State University

MATERIALS AND METHODS

Sample site

The sample site of this study was Barau Dikko Teaching Hospital Kaduna, Kaduna State. Nigeria, which lies between longitude 10° 31'36.1'' N and latitude 7°26'31.5'' E. The samples were collected from Antennal Units in Barau Dikko Teaching Hospital Kaduna. It is a Hospital that received patients from and within the metropolis and across the state.

Determination of Sample size

The sample size of the study was determined using the Cochran's formula (Cochran 1977) to calculate a representative sample for proportion as follows:

$N=Z^2 P (1-P)/d^2$

Where, n_o is the sample size z is the selected critical value of desired confidence level, p is the estimated proportion of an attribute that is present in the population, q = 1 –p and d is the desired level of precision.

The sample size of these study was calculated using the prevalence rate of 15.4% in Kano state (Egbebi and Famurewa 2011; Tijjani *et al*., 2012).

$N=Z^2 P (1-P)/d^2$

Where N = sample size, P = prevalence rate of previous ESBL (15.4%), Z = confidence interval (1.96) and D = allowable error (5%)

$N=Z^2 P (1-P)/d^2$

$N = 1.96^2 x\ 0.154 x (1-0.154)/ (0.05)^2$

N= 200

Therefore, the sample size of this study was 230.

Sample Collection

A total of 230 samples of urine were collected from antenatal patients of Barau Dikko Teaching Hospital, Kaduna. All the samples were collected in a sterile urine bottles which were packed in a clean 2 litres closed container and were transported to Medical Microbiology Laboratory of Kaduna State University for analysis. Patients sent to the Microbiology laboratory with suspected cases of Urinary Tract Infection were included in the study. While, patients sent to the Microbiology laboratory with suspected cases other than Urinary Tract Infection were excluded in the study. Structured questionnaire was administered to the patients that fulfil the consent form.

Isolation and Identification of Bacteria

The collected samples were plated on MacConkey agar and cetrimide agar using streak plate procedure and incubated at 37°C for 24 h. Thereafter, the cultures were examined for significant bacterial growth, after which the bacteria were identified based on colony morphology, Gram staining reaction and appropriate biochemical tests including Indole test, Methyl Red - Voges-Proskauer test, citrate utilizations test, urease test, Catalase test, motility test, hydrogen Sulphide Production along with carbohydrate fermentation test (Cowans and Still, 2004; Cheesbrough, 2006).

Antibiotic Susceptibility test

Isolates of *Pseudomonas aeruginos a*nd *Klebsiella pneumonia* were standardized by inoculating the biochemically identified isolates into a nutrient broth, which was then incubated at 37°C until the visible turbidity was equal to or greater than 0.5 McFarland standard and then subjected to sensitivity analysis against antibiotics on Mueller Hinton agar by modified Kirby-bauer disc diffusion technique using the following antibiotic discs: Ciprofloxacin (5ug), Cefotaxime (30ug), Ampicillin (30ug), Gentamycin (10ug), Erythromycin (E) 10µg, Pefloxacin (PEF) 30µg, Septrin (SXT) 30µg, Augumentin(AU) 30µg, Ofloxacin (OFX) 5µg and Streptomycin(S)*30*µg (CLSI 2009).

RESULTS

Table 1 shows the occurrence of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* isolated from urine samples of antenatal patients attending Barau Dikko Teaching Hospital Kaduna. The result revealed *Klebsiella pneumoniae* to have higher occurrence with 34 number of isolates (14.78%) compared to *Pseudomonas aeruginosa* with 17 number of isolates (7.39%) among pregnant women with UTI in Kaduna.

Table 1: Occurrence of Bacterial Isolates from Urine Samples of Antenatal Patients Attending Barau Dikko Teaching Hospital Kaduna

Bacteria	Sample size (n)	Number of Positive isolates (%)
Klebsiella pneumoniae		34 (14.78)
Pseudomonas aeruginosa		17 (7.39)
Total	230	51 (22.17)

Table 2 shows that Augmentin and Ciprofloxacin had the highest activity on *Klebsiella pneumonia* while Tarivid shows the lowest activity. Amoxicillin was most active on *Pseudomonas aeruginosa* and Tarivid with lowest activity.

Table 2: Antibiotic Susceptibility Pattern of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* Isolated from Urine Samples of Antenatal Patients Attending Barau Dikko Teaching Hospital

	Klebsiella pneumonia		*Pseudomonas aeruginosa*	
Antibiotics	Susceptible Isolates (%)	Resistant Isolates (%)	Susceptible Isolates (%)	Resistant Isolates (%)
S (10)	6(14.65)	16(47.06)	8(47.06)	6(35.29)
Am (30)	30(88.24)	14(41.18)	16(94.12)	7(41.18)
Au (10)	34(100)	16(47.06)	13(76.47)	7(41.18)
Cn (30)	13(38.24)	28(82.35)	8(47.06)	2(14.23)
Pef (30)	10(29.24)	11(64.71)	10(58.82)	7(41.18)
Ofx (30)	4(11.76)	13(38.24)	9(52.94)	7(41.18)
Stx (30)	15(44.17)	14(41.18)	8(47.06)	4(23.53)
Ch (30)	23(67.65)	16(47.06)	12(70.59)	7(41.18)
Sp (10)	6(26.47)	12(35.29)	11(64.71)	8(47.06)
Cpx (30)	34(100)	17(50.0)	14(84.35)	7(41.18)

NB: All intermediates are said to be resistant in this research according to CLSI 2018

KEY: S = Streptomycin, Am = Amoxicillin, Au = Augmentin, Cn = Gentamycin, Pef = Pefloxacin, Ofx = Tarivid, Stx = Septrin, Ch = Chloramphenicol, Sp = Sparfloxacin, Cpx = Ciprofloxacin, % = percentage.

The prevalence of bacteriuria due to both *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* was highest among married women who were between the ages of 21 and 30 years, in their third trimesters, monoporous, and unemployed, with only primary school education (Table 3).

Table 3: Socio-Demographic Characteristics among Antenatal Patients Attending Barau Dikko Teaching Hospital Kaduna

Characteristics	No. Tested (%) n=230	Percentage positive (%)
AGE		
11-20	23 (10.0)	12.8
21-30	126 (54.8)	40.4
31-40	65 (28.3)	24.6
41-50	16 (7.0)	13.9
>50	0 (0.0)	8.3
MARITAL STATUS		
Married	228 (99.1)	82.9
Divorced	2 (0.9)	17.1
EDUCATIONAL BACKGROUND		
Primary	105 (45.7)	52.6
Secondary	72 (31.3)	28.2
Tertiary	34 (14.8)	10.4
Others	19 (8.3)	8.8
GROUPS		
Employed	55 (23.9)	11.4
Unemployed	38 (16.5)	44.6
Student	40 (17.4)	24.3
Others	97 (42.2)	19.7
GESTATION PERIOD		
First trimester	25 (10.9)	5.8
Second trimester	133 (57.8)	26.9
Third trimester	72 (31.3)	67.3
PARITY		
None	23 (10.0)	21.2
Once	35 (15.2)	37.3
Twice	41 (17.8)	26.1
Trice	68 (29.6)	10.2
>4	63 (27.4)	5.2

KEY: n=total number

DISCUSSION

Urinary tract infections (UTIs), which occur as a result of colonization of urine and the invasion of any structure of the urinary tract by microorganisms such as bacteria, viruses, yeasts and protozoa, have been recognized as a common infection of human (Chijioke *et al*., 2016; Almehdawi *et al*., 2017). Among individuals presenting clinical symptoms of UTIs, females have been reported to show increased susceptibility, especially during pregnancy with significant maternal and fetal risks (Almehdawi *et al*., 2017; Vaishali and Aarti, 2017). The results of the present study indicated an overall UTIs prevalence of 22.17% among pregnant women attending antenatal care facility in Barau Dikko Teaching Hospital Kaduna. Different authors have reported widely varying bacteriuria among pregnant women. Muhammad and Muhammad (2019) reported an incidence rate of 15.4% UTIs among pregnant women in Kano state, Northern Nigeria. In a 2016 study conducted among pregnant women in Owerri, South-eastern Nigeria, a 25% bacteriuria was recorded by Onuorah *et al*. (2016). According to a study conducted by Oladipo (2013), prevalence of 56.7% UTIs among pregnant women in South-western Nigeria was recorded. In another study, 61.5% prevalence of UTI among pregnant women in Aba, South-eastern Nigeria was recorded by Ezeigbo *et al*., (2016). Immunological, physiological, anatomical and hormonal factors have been identified as responsible for incidences of urinary tract infections among pregnant women (Samuel *et al*., 2016). Almehdawi *et al*., (2017) indicated that shortened urethra, absence of prostatic secretion, contamination of urinary tract with fecal flora increase the risk of UTIs among women, conditions which are further exacerbated in pregnancy due to concomitant hemodilution, urinary stasis, decreased urine concentration and glycosuria, all of which favour bacterial colonization and growth within the urinary tracts. The weakened immune mechanisms associated with pregnancy also make pregnant women more susceptible to infection with bacterial pathogens (Almukhtar, 2018). Urinary tract and virginal trauma during sexual intercourse have also been put forward as probable causes of increased UTIs among women (Tamalli *et al*., 2013). The seeming disparity in prevalence of UTIs recorded in this study and those of Oladipo (2013) and Ezeigbo *et al*. (2016) which recorded higher prevalence may be due to the number of bacterial pathogens identified and the culture media used. In this study, only two organisms were of experimental interest, namely *Klebsiella* spp and *Pseudomonas aeruginosa* while in the studies by the aforementioned authors a wider range of bacterial pathogens were isolated and identified. *Klebsiella* spp and *Pseudomonas aeruginosa* have been variously identified in urine cultures of patients presenting with clinical symptoms of urinary tract infections (Oluwafemi *et al*., 2018; Odoki *et al*., 2019). In the present study, a prevalence of 14.78% infection with *K. pneumonia* was recorded among urine samples collected from the pregnant women. This closely agrees with the findings of Almehdawi *et al*. (2017), Chijioke *et al*. (2016), Oladipo (2013) Tamalli *et al*. (2013), and Umar *et al*. (2018) who reported prevalence of 17.3%, 17.2%, 16.8%, 13.3% and 10%, respectively, for *K. pneumonia* in urine cultures of pregnant women.

In a study by Mohammad and Mohammed (2019), *Pseudomonas aeruginosa* accounted for 14.8% of identified bacterial pathogen in the urine cultures of pregnant women in Kano, Northern Nigeria. Prevalence of 13.0% *P. aeruginosa* in urine samples obtained from pregnant women attending antenatal clinics in Aba, South-eastern Nigeria as recorded by Ezeigbo *et al*. (2016). According to a (2013) study, a prevalence of 2.6% in urine samples collected from pregnant women in Ile-Ife, Southwestern Nigeria was recorded by Oladipo. In another study, Farouk *et al*. (2019) reported 15.8% prevalence for *P. aeruginosa* among pregnant women in Kano, Northern Nigeria. The results from the present study showed that the prevalence of *Pseudomonas aeruginosa* among the pregnant women was 7.39%, a value marginally lower than most of the aforementioned authors. The differences in prevalence of both *Klebsiella* spp and *Pseudomonas aeruginosa* recorded in this and other studies may be due to differences factors including but not limited to socio-economic status, environmental condition, social

habit, personal hygiene and educational level of the women (Almukhtar, 2018; Farouk *et al*., 2019; Gebremariam *et al*., 2019). Urinary tract infections predispose both pregnant women and neonates to adverse outcomes. The expectant mother, with UTIs, has increased risks of pyelonephritis, premature labour, preterm rupture of the membranes, pre-eclampsia and anaemia of pregnancy. Neonates may develop fatal sepsis, experience intrauterine growth retardation and low birth weight (Ballen *et al*., 2014; Valentina and Srirangaraj, 2016).

The results of the antibiotic susceptibility indicated that the isolates of *Klebsiella pneumoniae* obtained from the urine cultures of the pregnant women exhibited varying degrees of susceptibility to the drugs. *Klebsiella pneumoniae* was most sensitive to the effects of Augmentin, Ciprofloxacin (100% susceptibility of the isolates), and Amoxicillin (88.24%). It was moderately sensitive to the effects of chloramphenicol (67.65%), Trimethoprim/Sulfamethoxazole (44.17%), Gentamycin (38.24%) and Pefloxacin (29.24%), while being least sensitive to the effects of Sparfloxacin (26.41%), Streptomycin (14.65%) and Ofloxacin (Tarivid) (11.76%). In a 2018 study, Balkhi *et al*. showed that *Klebsiella pneumonia* was highly sensitive to the effects of Ciprofloxacin and another Quinolone, Levofloxacin, as well as to the Aminoglycoside Gentamycin, and the β-lactams, Ampicillin and Augmentin, with Septrin showing only moderate activity.

The isolates of *Pseudomonas aeruginosa* identified in the urine cultures of the pregnant women also exhibited varying degrees of susceptibilities to the antibiotics tested. The highest susceptibility of isolates of *Pseudomonas aeruginosa* was observed in Amoxicillin (94.12%) followed by Ciprofloxacin (84.35%) and then Augmentin (76.47%), while being least susceptible to Chloramphenicol (41.18%), Sparfloxacin (35.29%), Pefloxacin (23.53%) and Tarivid (14.23%). On the other hand, isolates of *Pseudomonas aeruginosa* obtained from the urine cultures exhibited intermediate susceptibility to Streptomycin (70.59%), Trimethoprim (64.71%), and Gentamycin (58.82%). These results closely agree with those of Aernan and Umeh, (2016) who showed that *Pseudomonas aeruginosa* was very sensitive to the effects of both Augmentin (92.9%) and Ciprofloxacin (100%). However, their results showed that *Pseudomonas aeruginosa* was also highly sensitive to the effects of other quinolones (Ofloxacin, Pefloxacin and Sparfloxacin) as well as to the Aminoglycosides, Gentamycin and Streptomycin.

Similarly, the susceptibility pattern of the isolates of *Pseudomonas aeruginosa* from the urine cultures exhibited multiple drug resistance, a finding which agrees with that of Aernan and Umeh, (2016) who also reported that isolates of *Pseudomonas aeruginosa* obtained from urine samples of pregnant women were multidrug resistant. The occurrence of multidrug-resistant strains is increasing worldwide and limiting therapeutic options for clinicians (Anil *et al*., 2016). Akpan *et al.* (2019) noted that MDR is usually high against commonly used antibiotic, citing self-medication, unnecessary use of antibiotics and noncompliance to antibiotic regimen as some of the factors promoting the rise in multidrug resistance. The multidrug resistant phenotypes could be mediated by several mechanisms including multidrug efflux systems, enzyme production, outer membrane protein (porin) loss and target mutations (Aernan and Umeh, 2016).

Furthermore, the susceptibility/resistance pattern of *Klebsiella pneumoniae* to the antibiotics as observed from the present results also revealed the likelihood of ESBL production among *Klebsiella pneumoniae* isolates. This can be seen in its enhanced in the presence of a beta-lactamase inhibitor in Augmentin (Amoxicillin and Clavulanate) compared to when only a β-lactam drug (Amoxicillin) was used.

The highest prevalence of bacteriuria was recorded in pregnant women between ages 21-30 years followed by those between 31-40 years. These agree with the findings of Tamalli *et al*. (2013), Samuel *et al*. (2016); Laily *et al*. (2018); Nwachukwu *et al*. (2018) and Thapa *et al*. (2018); who reported high incidence of bacteriuria and/or urinary tract infections in pregnant women between ages 21 and 30 years. Odoki *et al*. (2019) had remarked that there is a significant association between age and prevalence of UTIs in pregnant women. Reasons that have been alluded to for these high incidences of UTIs among women within these age categories include associated increased sexual activity and multiple parity (Laily *et al*., 2018; Nwachukwu *et al*., 2018; and Oluwafumi *et al*., 2020).

Women in their third trimester had the highest prevalence of bacteriuria due to both *K. pneumoniae* and *P. aeruginosa*. Previous studies have reported varying prevalence of UTIs among women in their second and third trimesters of pregnancy, with the least prevalence recorded in the first trimester. In the study of Tamalli *et al.* (2013) and Akpan *et al*. (2019), peak prevalence of UTIs in pregnant women was recorded among those in their 3rd trimester of pregnancy, while Laily *et al*. (2018) recorded peak prevalence of UTIs during 2nd trimester. The increase risk of UTIs during the 2nd and 3rd trimesters may be due to increased urethral dilation, decreased bladder tone, decreased urine concentration, increased stasis and hormonal changes (Tamalli *et al*., 2013).

UTIs was most prevalent in primigravid women followed by those with 2 to 3 births with least prevalence recorded among those with four or more births as observed by Nwachukwu *et al*. (2018), Thapa *et al*. (2018) and Kaduma *et al*. (2019). This present result agrees with the findings of the aforementioned authors. While there are no tentative reasons proffered for this correlation between parity and prevalence of UTIs in pregnant women, it may not be unconnected with the lifestyle of women within this category. It is likely that women with their first pregnancy are newly or recently weds, and are more prone to increased frequency of coitus which may predispose them to UTIs due to vaginal trauma Laily *et al*., (2018). According to Tamalli *et al*. (2013), He noted that UTIs is more prevalent among uneducated than educated pregnant women. However, Akpan *et al*. (2019) in sampling the occurrence of bacteriuria among women visiting some primary health care in South-South Nigeria observed that UTIs is most prevalent among educated group of women, and that within those with some form of education, it is most prevalent in women with secondary school education and least among those with tertiary education. A study conducted by Oladeinde *et al*. (2015), also made similar observation in their study of UTIs among pregnant women in a traditional birth home in Benin City, Nigeria. It is expected that education, or literacy or some sort, should help reduce incidences of ill health and infections among a given population. This suggests a faulty education system that does not cater for sexual education, or poor learning outcome for the people so taught.

Conclusion

Klebsiella pneumonae and *Pseudomonas aeruginosa* are pathogens which colonize the urinary tracts and/or urine of pregnant women attending Barau Dikko Teaching Hospital, Kaduna with prevalence of 14.78 and 7.39 %, respectively. Isolates of *Klebsiella pneumonae* and *Pseudomonas aeruginosa* were highly sensitive to Augmentin, Ciprofloxacin, and Amoxicillin with *Klebsiella pneumonae* showing higher susceptibility to the antibiotics. Furthermore, both uropathogens exhibited antibiotic susceptibility patterns that were indicative of multidrug resistance with some isolates presenting as extended beta-lactamase producers (*Klebsiella pneumonae*: 11.76%; *Pseudomonas aeruginosa*: 14.29%). The result of the study shows that the prevalence of bacteriuria due to both *Klebsiella pneumonae* and *Pseudomonas aeruginosa* was highest among married women who were between the ages of 21 and 30 years, in their third trimesters, mono-parous, and unemployed, with only primary school education.

Acknowledgement

The author wishes to acknowledge staff of the Department of Microbiology Kaduna State University, the authorities of Federal Ministry of Health and Barau Dikko Teaching Hospital Kaduna for their vast contributions towards completion of the research work**.**

REFERENCES

Aernan P. T. and Umeh E.U. (2016). Molecular Characterization of Extended-Spectrum Beta Lactamase (ESBLs) genes in *Pseudomonas aeruginosa* from Pregnant Women Attending a Tertiary Health Care Centre in Makurdi, Central Nigeria. *International Journal of Scientific and Research Publications*; 6**(10)**: 19-24

Almehdawi, K. A., Ali, R.H. and Ismail, F.F. (2017). Bacteriuria in Pregnant and Non-Pregnant Women in Benghazi a Comparative Study. *Journal of Pharmacy and Biological Sciences.* **12**: 133-137.

Anil S., Sarita M., Pankaj P., Prabhat P and Dhiraj K.C. (2016). Prevalence of Extended Spectrum Beta-Lactamase (ESBL) Producing Multidrug Resistance Gram-Negative Isolates Causing Urinary Tract Infection. *EC Microbiology*; 4**(5)**: 749-755

Balkhi B., Mansy W., Alghadeer S., Alnuaim A., Alshehri A and Somily A. (2018). Antimicrobial susceptibility of microorganisms causing Urinary Tract Infections in Saudi Arabia. *Journal of Infection on Developing Countries*; 12**(4)**:220-227

Ballen V., Saez E., Benmessaoud R., Houssain T, Alami H., Barkat A., Kabiri M., Moraleda C., Bezad R., Vila J., Bosch J., Bassat Q and Soto S.M.. (2014). First report of a *Klebsiella pneumoniae* ST466 strain causing neonatal sepsis harbouring the blaCTX-M-15 gene in Rabat, Morocco. *FEMS Microbiology Letters*; 362**(1)**: 1-4

Behbahani M.R., Keshavarzi A., Pirbonyeh N., Javanmardi F., Khoob F., Emami A. (2019). Plasmid-related β-Lactamase Genes in *Pseudomonas aeruginosa* Isolates: A Molecular Study in Burn Patients. *Journal of Medical Microbiology*; 68**(12)**: 1740-1746

Cheesebrough, M. (2006). *District Laboratory Practical in Tropical Countries.* Part two, 2 edition Cambridge university press.

Chijioke, A. N., Vivian, N. N. and Christian, U. O. (2016). Prevalence and Antibiotic Susceptibility Pattern of *Staphylococcus aureus* Isolated from Various Clinical Specimens in South East Nigeria. Department of Microbiology, Imo State University 0f Owerri, Nigeria. 3(2): 00054

Cowans, S.T., Steel, K.J. (2004). Mnual for the Identification of MedicaL Bacvterias (3rd edition). Cambridge University Press. London.

Dabir S., Mohammadi J., Alizadeh A., Karimi F., Nori K., and Mahmoudi S. (2020). Investigation of the Prevalence of *CTX-M-1* Beta-Lactamase gene in Pseudomonas aeruginosa Strains Isolated from Urinary Tract Infections in Zanjan Hospitals, Iran. *South Asian Research Journal of Biology and Applied Biosciences*; 2**(2)**: 20-24

Egbebi, A. O. and Famurewa, O. (2011). Prevalence of Extended Spectrum Beta-Lactamase (ESBL) production among *Klebsiella pneumoniae* Isolated in Some Parts of South West Nigeria. Enterobacteriaceae in Europe. 13: 1-1

Farouk S.N., Ibrahim U.I., Abdullahi Y., Bello A.J., Muhammad A. (2019). Prevalence of *Klebsiella pneumoniae* Isolated from Pregnant Women with Urinary Tracts Infections. *Archives of Urology*; 2**(1)**: 32-38.

Gebremariam G., Legese H., Woldu Y., Araya T., Hagos K. and Wasihun A.G. (2019). Bacteriological profile, risk factors and antimicrobial susceptibility patterns of symptomatic urinary tract infection among students of Mekelle University, Northern Ethiopia. *BMC Infectious Diseases*; 19: 950.

Ghaima K.K., Abdulhassan A.A., Mahdi Z.H. (2018). Molecular Study of Extended Spectrum Beta-Lactamase (ESBL) Genes in *Pseudomonas aeruginosa* Isolated from Burns. *Biochemical Cell Archive*; 18**(1)**: 721-727

Kaduma, J., Seni, J., Chuma, C., Kirita, R., Mujuni, F., Mushi, M.F., van der Meer, F.and Mshana, S.E. (2019). Urinary Tract Infections and Preeclampsia among Pregnant Women Attending Two Hospitals in Mwanza City, Tanzania: A 1:2 Matched Case-Control Study. *International Journal of Biomedical Research*.

Laily, F., Lutan, D., Amelia, S., Tala MR.Z. and Nasution, T.A. (2018). Associated risk factors for urinary tract infection among pregnant women at Puskesmas Kenangan, Deli Serdang district. International Conference on Tropical Medicine and Infectious Diseases. 125

Muhammad, A. and Muhammad, S. A. (2019). Prevalence of Urinary Tract Infection among Pregnant Women in Kano, Northern Nigeria. Archives of Reproductive Medicine and Sexual Health, 2:23-29.

Nwachukwu, E., Onyebuchi, O. and Michael, O. (2018). Prevalence of urinary tract infections in pregnant women in Onitsha, Nigeria, *Journal of Bacteriology & Mycology*. 6

Oladeinde B.H., Omoregie R., Oladeinde O.B. (2015). Asymptomatic Urinary Tract Infection among Pregnant Women Receiving Ante-natal Care in a Traditional Birth Home in Benin City, Nigeria. *Ethiopian Journal of Health Sciences*; 25**(1)**: 3-8

Oladipo A. O. (2013). Prevalence of urinary tract infections (UTIs) among pregnant women attending antenatal clinic at Ile–Ife, South Western Nigeria. *Journal of Microbial & Biochemical Technology.* 5:4

Oluwafemi TT, Akinbodewa AA, Ogunleye A, Adejumo OA. (2018). Urinary tract infections and antibiotic sensitivity pattern of uropathogens in a tertiary hospital in South West, Nigeria. *Sahel Medical Journal*; 21:18-22.

Onuorah, S., Ogbonna, V. and Obika, I. (2016). Prevalence of Asymptomatic Bacteriuria among the Pregnant Women Receiving Antenatal Care at Federal Medical Centre Owerri, Nigeria. *Journal of Clinical Medicine*. 4**(1)**: 1 - 5.

Onwwuezobe A.I. and Orok F.E. (2015). Extended Spectrum Beta-Lactamase Producing Uropathogenes in Asymptomatic pregnant women attending Antenatal care in Urban Community Secondary Health facility. *African Journal of clinical and Experimental Microbiology*, 16**(1)**:49-53.

Rajivgandhia G., Muthuchamy M., Govindan R., Muthu P. and Natesan M. (2018). Detection of ESBL genes from ciprofloxacin resistant Gram-negative bacteria isolated from urinary tract infections (UTIs). 2:5-13.

Samuel, O., Victoria, O. and Ifeanyi, O. (2016). Prevalence of asymptomatic bacteriuria among the pregnant women receiving antenatal care at Federal Medical Centre Owerri, Nigeria. *Universal Journal of Clinical Medicine*; 4:1-5.

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

Tijjani, J., Arzai, A. H. and Sadiq, W. M. (2012). Antimicrobial Susceptibility pattern of Extended Spectrum Beta-lactamase Producers in Gramnegative Urogenital Isolates in Kano, Nigeria. *Bayero Journal of Pure and Applied Sciences,* 5**(1)**: 20-25.

Umar M., Maidoki I. A., Yaya A. A., Ajiya G. K., Jakheng S. P. E., Abdulkarim I. M. and Amuta I. C. (2018). Antibiotic Susceptibility Profile of *Klebsiella* Species Isolated from Pregnant Women with Dysuria Attending Selected Medical Centre in Northern Nigeria. *Asian Journal of Research and Reports in Urology*; 1**(1)**: 1-8

Vaishali, A. and Aarti, B. (2017). Prevalence of the urinary tract infections among pregnant women. *Journal of Applied Medical Sciences.* 5:376-378.

Valentina Y. and Srirangaraj S. (2016). Pregnancy associated Urinary Tract Infection: Prevalence and Screening. *International Journal of Current Microbiology and Applied Science*; 5**(1)**: 452-460