Antibiogram of Clinical Isolates of *Escherichia coli* and *Klebsiella* species Producing Extended Spectrum Beta Lactamase (ESBL)

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Abstract: The public health threat posed by bacteria producing extended spectrum beta lactamase (ESBL) is increasingly contributing to the global challenge of antimicrobial resistance (AMR) which is slowly ushering in a post antibiotic era – where no antibiotic is likely to work. AMR is a global health threat that warrant urgent steps to mitigate its growing ugly trend. This study investigated the susceptibility profile of ESBL-producing *Escherichia coli* and *Klebsiella* species – with the goal of informing Nigerian physicians on the best antibiotic therapy when ESBL-positive bacteria is implicated in an infection or disease. Standard microbiology technique was employed in the bacteriological analysis of clinical samples of urine and feaces (n=246) for the isolation and characterization of *Klebsiella* species and *Escherichia coli* isolates. ESBL production was phenotypically confirmed using the double disk synergy test (DDST) technique while susceptibility studies was carried out using the Kirby Bauer disk diffusion technique. 80 (50%) isolates of *E. coli* and 30 (18.75%) isolates of *Klebsiella* species were recovered from in-patients while 28 (17.5%) isolates of *E. coli* and 22 (13.76%) isolates of *Klebsiella* species were recovered from the out-patients samples. The result revealed that ESBL was phenotypically confirmed in 26 (31.71%) isolates of *E. coli*, 15 (18.29%) isolates of *Klebsiella* species from in-patients; and 7 (8.54%) isolates of *E. coli* and 4 (4.88%) isolates of *Klebsiella* species from out-patients samples. All *E. coli* and *Klebsiella* species isolates showed varied (high) resistance to the tested antibiotics with exception to imipenem (100%) to which the bacterial isolates showed complete susceptibility. Surveillance of ESBL-producing bacteria is advocated to assuage the nefarious activities of these multidrug resistant organisms in the hospital setting.

Keywords: ESBL, *E. coli, Klebsiella,* Antimicrobial resistance, Multidrug resistant bacteria

INTRODUCTION

According to the World health Organization, antimicrobial (antibiotic) resistance (AMR) is one of the top 10 public health threat facing humanity (Nasehi *et al.*, 2010). Low- and middle-income countries (LMICs) like Nigeria have higher (unreported) prevalence of AMR due to the high unrestricted use of antimicrobial agents in human, animal and other environments Meek *et al.* (2015). Multidrug resistant Gram-negative bacteria that produce extended spectrum beta lactamase (ESBL) are a threat to the effective management and treatment of bacterial infections caused by these pathogens (Jacoby *et al.*, 2005). According to ESBL-producing Gram negative bacteria are a huge global healthcare burden and have caused the large increase in the use of carbapenem antibiotics in human medicine. Carbapenems are potent antibacterial agents (e.g., imipenem) with stability against most beta-lactamases, and which are used for treating serious infections including those caused by ESBL-producing Gram negative bacteria (Ejikeugwu *et al.*, 2015; Franco *et al.*, 2010). The emergence and spread of ESBL bacteria which initially looked benign has become one of the major resistance problems that now bedevil our health sector globally, putting the available antibiotics for treatment of bacterial related infections into jeopardy. ESBLs are plasmid-mediated beta-

lactamases capable of hydrolyzing many beta-lactam antibiotics including third-generation cephalosporins and monobactams (Ejikeugwu *et al*., 2012; Al-Agamy *et al*., 2009; Yan *et al*., 2000), but are inhibited by clavulanic acid, a beta – lactamase inhibitor (Bonnet, 2004). AMR especially those caused by ESBL bacteria is a growing public health problem that may lead to long hospitalization, severity of illness and economic burden.

Bacteria species including *Klebsiella* and *Escherichia coli* under certain conditions can become resistant to antibiotics of different classes, and are generally called multi-resistant Gram-negative bacteria (Paterson and Bonomo, 2005). ESBLs are detected mostly in members of the *Enterobacteriaceae* family, and they often contain resistance determinants for other classes of antibiotics like the aminoglycosides, sulfonamides, fluoroquinolones which are readily transmissible from one strain of organism to another and between different species of Gram-negative bacteria (Munday *et al*., 2004; Peirano and Pitout, 2010; Jacoby and Munoz-Price, 2005). Several cases of ESBL-producing bacteria have been reported across the world in both clinical and non-clinical samples in Nigeria, Japan, South Korea, and Egypt (Ejikeugwu *et al*., 2012; Ejikeugwu *et al*., 2013;Song *et al*., 2009;Peirano and Pitout, 2010; Zorgani *et al*., 2017). ESBL-producing bacteria are responsible for the cause of community-onset of urinary tract infections (UTIs), and they have disseminated worldwide (Paterson *et al*., 2005; Peirano and Pitout, 2010). In Korea, members of the CTX-M ESBL types have been extensively described, and these ESBL-types were found to be reported in members of the *Enterobacteriaceae* family including clinical isolates of *E. coli* and *Klebsiella* species (Song *et al*., 2009). Also in a recent study in Tripoli, Libya, the occurrence of ESBL was reported in clinical isolates of *E. coli* from five major hospitals in Tripoli (Zorgani *et al*., 2017). To date, there is paucity of information regarding the actual disease burden and frequency of infection caused by ESBL-producing bacteria in Nigeria. This study determined the antimicrobial susceptibility profile of clinical isolates of *E. coli* and *Klebsiella* species producing ESBL – with the overarching goal being to update on the most effective antibacterial agent (combination) required for their treatment.

MATERIALS AND METHODS

Ethical approval, Sample collection and processing

Ethical clearance for this study was obtained from the Research and Ethics Committee of Alex Ekwueme Federal University Teaching Hospital, Abakaliki (AEFUTHA), Ebonyi State, Nigeria; and sample size was determined by the Cochran's formular based on a previously published data on the prevalence rates of ESBL-producing Gram negative bacteria in southeast Nigeria (Ejikeugwu *et al*., 2012).A total of 246 clinical samples of urine and feaces were collected from the microbiology section of AEFUTHA and further processed for the isolation of Gram negative bacteria.

Culture and identification

The urine samples were each cultured on MacConkey agar (MAC) and cysteine lactose electrolyte deficient (CLED) medium and cultured at 37^{o}C for 18-24 hours (Cheesbrough, 2000; Ejikeugwu *et al*., 2012). After which, suspect bacterial colonies were sub-cultured onto freshly prepared MAC and CLED plates for the isolation of pure cultures following above conditions. Suspect colonies of *Escherichia coli* and *Klebsiella* species were subjected to microscopic and biochemical tests including Gram staining, urease test, citrate test and indole test. Isolates confirmed as *E. coli* and *Klebsiella* species were stored in nutrient agar slants and stored in the refrigerator for further tests.

ESBL screening and confirmatory test

ESBL production was phenotypically confirmed in all the *E. coli* and *Klebsiella* species clinical isolates by the double disk synergy test (DDST) method (Ejikeugwu *et al*., 2012; Ejikeugwu *et al*., 2013). DDST was performed as a standard disk diffusion assay on Mueller-Hinton (MH) agar plates (Oxoid, UK). Antibiotic disks of amoxicillin-clavulanic acid (20/10 µg) was placed at the center of the MH agar plate, and antibiotic disks containing cefotaxime (30 µg) and ceftazidime (30 µg) was each placed at a distance of 15 mm from the central disc (amoxicillin/clavulanic acid). The plates were incubated at 37^{o}C for 18-24 hours. ESBL production was inferred phenotypically when the zones of inhibition of the cephalosporins (Cefotaxime 30 µg or ceftazidime 30 µg) was expanded by the amoxicillin/clavulanic acid disk (20/10 µg). However, a ≥ 5mm increase in the inhibition zone diameter for either of the cephalosporins tested in combination with amoxicillin/clavulanic acid versus its zone when tested alone confirms ESBL production phenotypically (Bradford, 2001; Ejikeugwu *et al*., 2012).

Antimicrobial susceptibility test (AST)

The resistance and susceptibility patterns of the ESBL positive *E. coli* and *Klebsiella* species clinical isolates were determined by the Kirby-Bauer disk diffusion method following the guidelines of the Clinical Laboratory Standard Institute (CLSI) using overnight cultures adjusted to 0.5 McFarland turbidity standards (CLSI, 2005). The antibiotic disks that were used include amoxicillin/clavulanic acid (20/10 µg), ceftriaxone (30 µg), cefepime (30 µg), cefotaxime (30 µg), ceftazidime (30 µg), ciprofloxacin, (5 µg), gentamicin (10 µg), ertapenem (10 µg), imipenem (10 µg), meropenem (10 µg), ofloxacin (5 µg), amikacin (10 µg), levofloxacin (10 µg), aztreonam (30 µg), nitrofurantoin (10 µg) and sulphamethoxazole/trimethoprim (25 µg). All antibiotics disks were procured from Oxoid Limited (Oxoid, UK). Susceptibility testing was performed on MH agar plates and was incubated at 37^{o}C for 18-24 hours (Ejikeugwu *et al*., 2013).The inhibition zone diameters (IZDs) produced by the antibiotic disks were measured and recorded and interpreted as per the CLSI guidelines as susceptible and resistance (CLSI, 2005).

RESULTS

The result of the study shows the distribution of *Escherichia coli* and *Klebsiella* species isolates recovered from the urine samples of in- and out-patients samples bacteriologically analyzed in this study. Overall, a total of 80 (50%) isolates of *E. coli* and 30 (18.75%) isolates of *Klebsiella* species were recovered from in-patients while 28 (17.5%) *E. coli* isolates and 22 (13.76%) isolates of *Klebsiella* species were recovered from the out-patients samples (Table 1).

Table 1: Frequency of bacteria isolates from in-patients and out-patients samples

Isolate source	In-patients (%)		Out-patients (%)	
	E. coli No (%)	*Klebsiella* spp. No (%)	*E. coli* No (%)	*Klebsiella* spp. No (%)
Urine	50 (31.25)	20 (12.50)	20 (12.50)	15 (9.38)
Faeces	30 (18.75)	10 (6.25)	8 (5.00)	7 (4.38)
Total	**80 (50.00)**	**30 (18.75)**	**28 (17.50)**	**22 (13.76)**

The frequency of ESBL-producing bacterial isolates from in-patients and out-patients is shown in Figure 1. It revealed that 26 (31.71%) *E. coli* and 15 (18.29%) *Klebsiella* species isolates were recovered from in-patients while a total of 7 (8.54%) *E. coli*

and 4 (4.88%) *Klebsiella* species were recovered from the out-patients samples investigated in this study.

The result of antibiotic susceptibility pattern of the ESBL-producing *E. coli* and *Klebsiella* species from in-patient samples is shown in Table 2.ESBL-producing *E. coli* from urine isolates of in–patients were found to be highly susceptible to imipenem (100.00 %), ciprofloxacin (92.31 %), gentamicin (88.46 %) and norfloxacin (88.46 %). Only one *E. coli* isolate showed susceptibility to cefoxitin. Reduced susceptibility of the ESBL-producing *E. coli* isolates were found against cefotaxime (84.61 %), ceftriaxone (80.76 %), nalidixic acid (76.92 %), aztreonam (65.38 %), ceftazidime (61.54 %), cefepime (46.15 %), sulfamethoxazole-trimethoprim (30.76 %), doxycycline (26.92 %), cefoxitin 5 (19.23 %), norfloxacin (11.54 %) and ciprofloxacin (7.69 %). For isolates of ESBL-producing *Klebsiella* species from in-patients, ciprofloxacin (100%), gentamicin (93.33), norfloxacin (73.33) and aztreonam (60%) were the most effective antibiotics.

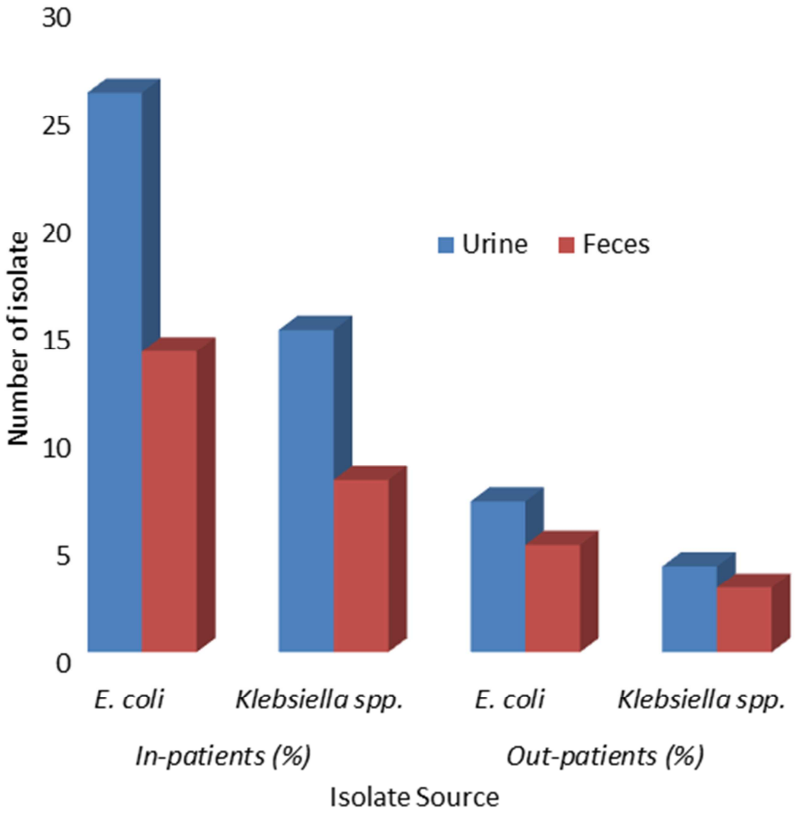

Figure 1: Distribution of ESBL-producing bacterial isolates from in-patients and out-patients.

Overall, the ESBL-producing *E. coli* isolates showed high susceptibility to imipenem (92.86), ciprofloxacin (92.86%), gentamicin (71.42%), nalidixic acid (87.50%) and norfloxacin (64.29%). Imipenem (100%), cefoxitin, nalidixic acid (87.50%), ciprofloxacin (87.50%) and gentamicin (75%) were the most effective antibiotics against the ESBL-producing *Klebsiella* isolates.

Table 2. Antibiotic susceptibility pattern of ESBL-producing *E. coli* and *Klebsiella* species isolates from urine samples of in-patients

Antibiotics (µg)	*E. coli*		*Klebsiella* species	
	Sensitive No (%)	Resistant No (%)	Sensitive No (%)	Resistant No (%)
CAZ (30)	10 (38.46)	16 (61.54)	3 (20.00)	12 (80.00)
IMP (10)	42 (100.00)	0 (0.00)	5 (33.33)	10 (66.67)
CRO (30)	5 (19.23)	21 (80.76)	8 (53.33)	7 (46.67)
CTX (30)	4 (15.38)	22 (84.61)	9 (60.00)	6 (40.00)
FOX (30)	21 (80.76)	5 (19.23)	5 (33.33)	10 (66.67)
CEP (30)	14 (53.84)	12 (46.15)	8 (53.33)	7 (46.67)
ATM (30)	9 (34.61)	17 (65.38)	9 (60.00)	6 (40.00)
SXT (5)	18 (69.23)	8 (30.76)	2 (14.29)	12 (85.71)
DO (30)	19 (73.08)	7 (26.92)	5 (33.33)	10 (66.67)
NOR (10)	23 (88.46)	3 (11.54)	11 (73.33)	4 (26.67)
NA (30)	6 (23.08)	20 (76.92)	10 (66.67)	5 (33.33)
CN (10)	23 (88.46)	3 (11.54)	14 (93.33)	1 (6.67)
CIP (5)	24 (92.31)	2 (7.69)	15 (100.00)	0 (0.00)

Key: ATM = aztreonam, CAZ = ceftazidime, CRO = ceftriaxone, CTX = cefotaxime, FOX = cefoxitin, IMP = imipenem, CEP = Cefepime, SXT = sulfamethoxazole-trimethoprim, DO = Doxycycline, NOR= Norfloxacin, NA = Nalidixic acid CN = gentamicin and CIP = ciprofloxacin

Table 3. Antibiotic susceptibility pattern of ESBL-producing *E. coli* and *Klebsiella* species isolates from faecal samples of in-patients

Antibiotics (µg)	*E. coli*		*Klebsiella* species	
	Sensitive No (%)	Resistant No (%)	Sensitive No (%)	Resistant No (%)
CAZ (30)	5 (37.71)	9 (64.29)	3 (37.50)	5 (62.50)
IMP (10)	13 (92.86)	1 (7.14)	8 (100.00)	0 (0.00)
CRO (30)	3 (21.43)	11 (78.57)	2 (25.00)	6 (75.00)
CTX (30)	4 (28.57)	10 (71.43)	0 (0.00)	8 (100.00)
FOX (30)	12 (85.71)	2 (14.29)	7 (87.50)	1 (12.50)
CEP (30)	3 (21.43)	11 (78.57)	2 (25.00)	6 (75.00)
ATM (30)	2 (14.29)	12 (85.71)	1 (12.50)	7 (87.50)
SXT (5)	8 (57.14)	6 (42.86)	5 (62.50)	3 (37.50)
DO (30)	7 (50.00)	7 (50.00)	4 (50.00)	4 (50.00)
NOR (10)	9 (64.29)	5 (35.71)	6 (75.00)	2 (25.00)
NA (30)	12 (87.50)	2 (12.50)	7 (87.50)	1 (12.50)
CN (10)	10 (71.42)	4 (28.57)	6 (75.00)	2 (25.00)
CIP (5)	13 (92.86)	1 (7.12)	7 (87.50)	1 (12.50)

Key same as in Table 2

The susceptibility of the ESBL-producing *E. coli* and *Klebsiella* species isolates from urine and faecal samples of out-patients is shown in Table 4 and 5. The ESBL-producing *E. coli* isolates from urine samples of out-patients were highly susceptible to imipenem (100%), cefoxitin (85.71%), nalidixic acid (87.50%) and ciprofloxacin (85.71%). On the other hand, the *Klebsiella* species isolates recovered from urine samples showed susceptibility to imipenem (100%) and ciprofloxacin, nalidixic acid, norfloxacin, sulphamethoxazole-trimethoprim and cefoxitin at a rate of 75% each. For the *E. coli* isolates from faecal samples,

susceptibility was recorded against imipenem, ciprofloxacin, and gentamicin at the rates of 100%, 80% and 80%. The *Klebsiella* species isolates from faecal samples were found to be highly susceptible to imipenem (100%), ciprofloxacin (100%), norfloxacin (100%) and gentamicin (100%).

Table 4. Antibiotic susceptibility pattern of ESBL-producing *E. coli* and *Klebsiella* species isolates from urine samples of out-patients

Antibiotics (µg)	***E. coli***		***Klebsiella* species**	
	Sensitive No (%)	**Resistant No (%)**	**Sensitive No (%)**	**Resistant No (%)**
CAZ (30)	3 (42.86)	4 (57.14)	1 (37.50)	3(62.50)
IMP (10)	7 (100.00)	0 (0.00)	4 (100.00)	0 (0.00)
CRO (30)	2 (28.57)	5 (71.43)	1 (25.00)	3 (75.00)
CTX (30)	0 (0.00)	7 (100.00)	0 (0.00)	4 (100.00)
FOX (30)	6 (85.71)	1 (14.29)	3 (75.00)	1 (25.00)
CEP (30)	2 (28.57)	5 (71.43)	1 (25.00)	3 (75.00)
ATM (30)	1 (14.50)	6 (87.71)	1 (25.00)	3 (75.00)
SXT (5)	5 (71.43)	2 (28.57)	3 (75.00)	1 (25.00)
DO (30)	3 (42.86)	4 (57.14)	2 (50.00)	2(50.00)
NOR (10)	5 (71.43)	2 (28.57)	3 (75.00)	1(25.00)
NA (30)	6(87.50)	1 (12.50)	3 (75.00)	1 (25.00)
CN (10)	5 (71.43)	2 (28.57)	3 (75.00)	1 (25.00)
CIP (5)	6(85.71)	1 (14.29)	3 (75.00)	1 (25.00)

Key: ATM = aztreonam, CAZ = ceftazidime, CRO = ceftriaxone, CTX = cefotaxime, FOX = cefoxitin, IMP = imipenem, CEP = Cefepime, SXT = sulfamethoxazole-trimethoprim, DO = Doxycycline, NOR= Norfloxacin, NA = Nalidixic acid CN = gentamicin and CIP = ciprofloxacin

Table 5. Antibiotic susceptibility pattern of ESBL-producing *E. coli* and *Klebsiella* species isolates from faecal samples of out-patients

Antibiotics (µg)	***E. coli***		***Klebsiella* species**	
	Sensitive No (%)	**Resistant No (%)**	**Sensitive No (%)**	**Resistant No (%)**
CAZ (30)	1 (20.00)	4 (80.00)	1 (33.33)	2 (66.67)
IMP (10)	5 (100.00)	0 (0.00)	3 (100.00)	0 (0.00)
CRO (30)	2 (40.00)	3 (60.00)	1 (33.33)	2 (66.67)
CTX (30)	2 (40.00)	3 (60.00)	0 (0.00)	3 (100.00)
FOX (30)	3 (60.00)	2 (40.00)	1 (33.33)	2 (66.67)
CEP (30)	2 (40.00)	3 (60.00)	0 (0.00)	3 (100.00)
ATM (30)	1 (20.00)	4 (80.00)	1 (33.33)	2 (66.67)
SXT (5)	2 (40.00)	3 (60.00)	0 (0.00)	3 (100.00)
DO (30)	3 (60.00)	2 (40.00)	1 (33.33)	2 (66.67)
NOR (10)	1 (20.00)	4 (80.00)	3 (100.00)	0 (0.00)
NA (30)	3 (60.00)	2 (40.00)	2 (66.67)	1 (33.33)
CN (10)	4 (80.00)	1 (20.00)	3 (100.00)	0 (0.00)
CIP (5)	4 (80.00)	1 (20.00)	3 (100.00)	0 (0.00)

Key: ATM = aztreonam, CAZ = ceftazidime, CRO = ceftriaxone, CTX = cefotaxime, FOX = cefoxitin, IMP = imipenem, CEP = Cefepime, SXT = sulfamethoxazole-trimethoprim, DO = Doxycycline, NOR= Norfloxacin, NA = Nalidixic acid CN = gentamicin and CIP = ciprofloxacin

DISCUSSION

In this study, the antimicrobial susceptibility profiles of ESBL-producing clinical isolates of *Escherichia coli* and *Klebsiella* species from both in- and out-patients in Abakaliki metropolis, Nigeria were investigated – with the goal to provide an update on the susceptibility profiles of these multidrug resistant bacteria so as to help clinicians/physicians know the optimal antibacterial options to recommend for people infected by these organisms. ESBL was phenotypically detected in 26 isolates of *E. coli* (31.71%) and 15 isolates of *Klebsiella* species (18.29%) for clinical samples obtained from in-patients while 7 isolates of *E. coli* (8.54%) and 4 isolates of *Klebsiella* species (4.88%) were phenotypically confirmed as ESBL producers. Gram negative bacteria including *E. coli* and *Klebsiella* species that produces ESBL has additional advantage to resist the antimicrobial onslaught of beta-lactam agents and some non-beta lactams, thereby limiting antibacterial treatment options in the face of a serious infection (Jacoby and Munoz-Price, 2005; Ejikeugwu *et al*.,2016). It was observed that the frequency of ESBL positive bacteria isolated from in-patients samples were greater than those recovered from the clinical samples of the out-patients. This could connote to the dissemination of ESBL-producing bacteria in the hospital environment since ESBL bacteria are a notable cause of nosocomial infections around the world (Boualiegue-Godet *et al*., 2005; Chong *et al*., 2011; Dalela, 2012).According to Dalela (2012) and Dinesh *et al*.(2014), ESBL-producing bacteria are as much a problem in the non-hospital environment (or the community) as in the hospital environment where antibiotic usage is usually heavy. Since nosocomial bacterial infections constitute a substantial cause of morbidity and mortality in most developing countries, it is vital to enhance the capacity of hospital laboratories in Nigeria to ensure prompt and accurate detection and reporting of ESBL-producing bacteria so that patients prognosis can be improved through accurate administration of antibacterial therapy.

The results of the antimicrobial susceptibility studies carried out on the ESBL-producing *Klebsiella* species and *Escherichia coli* isolates show~~ed~~ that the ESBL-producing bacteria from both in-patients and out-patients were multidrug resistant as reduced susceptibility of the *E. coli* isolates was recorded against cefoxitin (31.11%), aztreonam (31.11%), piperacillin (33.33%), cefepime (35.55%) and cefoperazone (27.77%). On the other hand, the *Klebsiella* species isolates also showed remarkable resistance to cefotaxime (100%), ceftriaxone (75 %), cefepime (75%) and ceftazidime (62.50%) – which are all cephalosporins. *Klebsiella* species isolates also showed substantial levels of resistance to the monobactams, aztreonam (87.50%). The most effective antibacterial agents against the ESBL-producing *E. coli* isolates were imipenem (100%), ciprofloxacin (100%) and tazobactam (87.22%). Cefoperazone-sulbactam (76.67%), amoxicillin-clavulanic acid (75.55%) and ceftazidime-clavulanate (66.11%) were also effective against the ESBL-producing *E. coli* isolates. The ESBL-producing *Klebsiella* species were also found to be susceptible to imipenem (100%), ciprofloxacin (100%), nalidixic acid (87.50%) and gentamicin (75%). Previous reports in Nigeria and India corroborates to the susceptibility of ESBL-producing bacteria to imipenem as reported in this present study (Akram and Shahid, 2007; Padmini and Appalaraju, 2004; Ejikeuwgu *et al*., 2013). Elsewhere, similar results of susceptibility of ESBL-producing *E. coli* and *Klebsiella* species isolates to imipenem, piperacillin-tazobactam, cefoperazone-sulbactam, and ceftazidime-clavulanate have been reported with slight variations (Mekki *et al*., (2010; Messai *et al*., 2006). Carbapenems (e.g., imipenem) are known to have good antibacterial activity against Gram-negative bacteria including those known to produce ESBL (Toleman *et*

al., 2005; Walsh *et al*., 2005; Ejikeugwu *et al*., 2018).

Due to the multidrug resistance profile of ESBL-producing bacteria, the study extended to include some non-beta lactam agents known to be effective against the organism. The susceptibility of the ESBL-producing bacteria reported in this study to some members of the fluoroquinolones (e.g., ciprofloxacin) and aminoglycosides (e.g., gentamicin) indicates that treatment regimens for ESBL infections can be supplemented with non-beta lactam agents to improve patient's prognosis. Since the detection of ESBLs is associated with health problems, it is beneficial to always be on the lookout for these multidrug resistant organisms in order to mitigate their development and dissemination within the hospital environment.

CONCLUSION

This study reports the prevalence of ESBL-producing *Klebsiella* species and *E. coli* isolates from clinical samples of in- and out-patients in a tertiary hospital in Abakaliki. The ESBL-producing *Klebsiella* species and *E. coli* isolates were found to be highly resistant to the tested antibiotics with exception to imipenem to which the bacterial isolates showed complete susceptibility to. The study advocates continues surveillance of ESBL-producing bacteria for correct antibiotic treatment management and avoidance of the increasing antibiotic resistance.

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