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Prevalence and Antimicrobial Susceptibility of ESβL-Producing *Klebsiella pneumoniae* in School Children: A Study in Abakaliki Metropolis, Ebonyi State, Nigeria

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ABSTRACT

Background and Aim: ESBL-producing bacteria are a significant public health problem due to their resistance to multiple antibiotics, making infections caused by these organisms challenging to treat. The study surveyed the prevalence of ESβL-producing *Klebsiella pneumoniae* in Abakaliki using 600 urine samples.
Materials and Methods: A 30-50 ml sample of urine midstream was collected in a sterile container and immediately taken to laboratory for analysis. The isolation and identification of *K. pneumoniae* were performed using standard microbiological techniques. Antimicrobial susceptibility testing was performed using the Kirby Bauer disc diffusion technique on Mueller-Hinton agar, following the Clinical and Laboratory Standards Institute (CLSI) procedure.
Results: Out of the 600 urine samples from primary and secondary school children, 96 (16 %) *K. pneumonia* isolates were recovered, 29(4.8 %) from primary and 67(11.2 %) from secondary school children. Susceptibility test results showed that the test organisms were susceptible to gatifloxacin 68(70.8 %), Ofloxacin 65(67.7 %), pefloxacin 65 (67.7 %), ciprofloxacin 71(74 %), nitrofurantoin 87(90.6 %), but showed resistance to tetracycline 33(34.4 %), sulphamethoxazole/trimethoprim 30(31.3 %), and streptomycin 36(37.65 %). The test organisms were also shown to be susceptible to beta-lactam antibiotics: Ceftazidime 67(69.8 %), imipenem 81(84.4 %), and cefoxitin 77(80.20 %) but showed resistance to ceftriaxone 32(33.3 %) and cefotaxime 26(27.1 %). Out of 96 isolates of *K. pneumoniae* screened for the presence of ESβL enzymes, 17(17.7 %) were positive. ESβL-producing organisms showed resistance to three or more antibacterial classes and thus exhibited multi-drug-resistant patterns.
Conclusion: This study highlights the resistance to commonly used antibiotics by the isolates, emphasizing the need for ongoing surveillance and infection control. The findings provide crucial data for preventing and managing ESβL infections, thus addressing this critical public health issue.

1. Introduction

Antimicrobial resistance (AMR) is a major global health concern, driven by the continuous evolution of drug-resistant pathogens. Among these, Extended-Spectrum Beta-Lactamase (ESβL)-producing bacteria, particularly *Klebsiella pneumoniae*, pose a significant threat due to their ability to break down a wide range of β-lactam antibiotics, thus making them ineffective [1,2]. Understanding the prevalence and resistance patterns of ESβL-producing *K. pneumoniae* strains is crucial to guide appropriate therapy and infection control measures.

The spread of extended-spectrum beta-lactamase (ESβL)-

producing *K. pneumoniae* is a major concern in public health as it limits treatment options and increases the risk of morbidity and mortality [3, 4]. These bacteria have been reported globally, with varying rates of prevalence. It is essential to monitor and control the spread of ESβL-producing *K. pneumoniae* to prevent further harm [5,6].

The production of ESβL enzymes confers resistance to a broad range of beta-lactam antibiotics, including third-generation cephalosporins, which are often used as first-line treatment for *K. pneumoniae* infections [7]. Most worrisome is the fact that these strains are the product of both uninterrupted evolution and unrestricted antimicrobial usage [8]. The coming on board of ESβL producers has posed an excellent threat within the use of the many classes of antibiotics more especially, cephalosporins. A situation, further exacerbated by undeniable fact that Beta-Lactam antimicrobial agents are the most commonly used treatment for bacterial infections and continue to be a primary cause of resistance to beta-lactam antibiotics in Gram-negative bacteria worldwide. The overexposure of bacterial strains to multiple beta-lactams has resulted in the continuous production and mutation of beta-lactamases in these bacteria. Consequently, their activity has expanded even against newly developed beta-lactam antibiotics. These enzymes are referred to as extended-spectrum beta-lactamases (ESβLs) [9, 10]. Treatment of those multiple drug-resistant organisms may be a therapeutic challenge.

Extended-spectrum beta-lactamases (ESβLs) are enzymes that arise from mutation in genes commonly found on plasmid and are transmitted between bacteria species. They are known for their ability to hydrolyze beta-lactam antibiotics such as penicillins, cephalosporins, and monobactams, resulting in antimicrobial therapy failure" [11]. Community-acquired ESβL on the other hand, is the presence of ESβL-producing organisms in individuals who are not admitted or attending hospital or presenting any clinical signs of any disease. It could also be defined as an infection acquired by someone who has not been recently (within the past years) hospitalized nor had a medical procedure like dialysis, surgery, catheterization, etc [7].

In addition to Klebsiella *pneumoniae* and *Escherichia coli*, other organisms known to produce extended-spectrum beta-lactamases (ESBLs) include *Enterobacter* spp., *Serratia* spp., *Proteus mirabilis*, *Citrobacter freundii*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Salmonella* spp., and *Shigella* spp. These bacteria have acquired the ability to produce ESBLs, enzymes that confer resistance to many beta-lactam antibiotics, thus, complicating treatment options for infections caused by these pathogens.

In recent years, there has been a growing concern regarding the prevalence of ESβL-producing organisms from the family enterobacteriaceae, particularly *K. pneumoniae*, across different regions worldwide. *Klebsiella pneumoniae* is a type of bacteria that can cause infections in hospitals and the community [1,2]. It is an opportunistic pathogen, that can cause infections in individuals already ill or those with weakened immune systems. A study by [12] reported a high incidence of ESβL-producing *K. pneumoniae* in hospitalized patients in Saudi Arabia. These reports on the incidence of ESβL-producing *K. pneumoniae* highlights the global spread of these drug-resistant strains. Similarly, research [13] revealed a significant prevalence of ESβL-producing Enterobacteriaceae in community settings in Uganda, emphasizing the need for surveillance and intervention strategies beyond healthcare facilities.

In Nigeria, limited studies have investigated the prevalence of ESβL-producing pathogens, particularly in children's populations. A study conducted by Eze [14] in Enugu state highlighted the emergence of ESβL-producing Enterobacteriaceae in children. The study emphasized that comprehensive antimicrobial stewardship programs and infection control measures are crucial in paediatric healthcare settings [14]. In Abakaliki Ebonyi State, ESβL presence has been established in four major hospitals by Iroha *et al*., [15]. There is a paucity of information on the community-acquired ESβL in Abakaliki. More so, few ESβL reports were on *E. coli*, not *Klebsiella spp.*

Against these backdrops, we designed this research work to evaluate the prevalence and antibiotic resistance pattern of community-acquired ESβLs in Abakaliki Ebonyi state, Nigeria. The study sought to elucidate the extent of ESβL dissemination in a vulnerable population. Through the use of standardized methods for bacterial isolation and antimicrobial susceptibility testing, the study aimed to evaluate antibiotic resistance profiles of ESβL-producing *K. pneumoniae* strains.

Material and Methods

Study Area

This research was conducted within the primary and secondary school in Abakaliki of Ebonyi State. Abakaliki is an important urban centre with a large population of primary and secondary school children.

Abakaliki comprises parts of the Ebonyi, Abakaliki, Ezza North, Ohaukwu, and Ezza South Local Government

Areas. It serves as an urban centre, accommodating administrative, commercial, and industrial activities. Geographically, it is located at a longitude of 8° 6′ 6″ E and a latitude of 6° 22′ 28″ N, in the lower belt of Nigeria, atop elevated terrain surrounded by tropical rainforest. The area spans approximately 51 square kilometres, with agriculture as the dominant activity. Various water bodies, including the Ebonyi River, which is a major tributary of the Cross River, traverse the district. Abakaliki lies about 84 kilometres east of Enugu and shares borders with Enugu State to the west, Benue State to the north, and Abia State to the south.

Ethical Clearance

The study received ethical approval from the ethical committee of Ebonyi Hospital Management Board Ethical committee with reference number: EB/SHMB/OD/2009/0091.

The research was conducted based on a thorough knowledge of the scientific literature, an adequate laboratory protocol, and other relevant sources of information guiding this research project, by the World Medical Association (WMA) declaration of Helsinki on the principles for medical research involving human and animal subjects and identifiable human/animal material/data [16].

Sample collection

A total of 600 urine samples were collected from Abakaliki of Ebonyi State, where 300 urine samples were from primary school children within the age range of 6-11 and 300 from secondary school children within the age range of 11-16 years.

Isolation and Characterization of Bacteria Isolates

A total of 96 isolates of *Klebsiella pneumonia* were isolated from 600 urine samples of primary and secondary school children from Abakaliki of Ebonyi State. After 24 hrs incubation of the test organism in a MacConkey, blood agar and CLED agar plate (Oxoid UK), a single colony of bacteria isolates that appeared grey-white in blood agar, mucoid pink colonies on MacConkey agar, and blue-green colonies on CLED were purified and identified to be *Klebsiella pneumonia* which was further corroborated using Gram staining, microscopy, and standard biochemical tests [17]. The pure isolates were transferred to a 5 ml nutrient agar slant and stored in a refrigerator at 4°C for further characterization.

Antimicrobial Susceptibility Test

This was done using the Kirby Bauer disc diffusion technique. A Mueller-Hinton agar plate was prepared according to manufacturer's specification and 0.5 ml of 0.5 MacFarland equivalent standard of the test organism was inoculated and allowed for 3 minutes for pre-diffuse of the test organism before placing antibiotic disc. The plates were then incubated at 37^0C for 24hr and the radial zones of inhibition were taken and interpreted following the Clinical and Laboratory Standards Institute (CLSI) criteria [18]. Multiple drug-resistant (MDR) organisms were identified as resistant to three or more antibacterial classes.

Susceptibility Test with Beta-lactam Antibiotics Disc

Plates for sensitive tests were prepared as stated above and ceftazidime (30µg), cefoxitin (30µg), imipenem (30µg) ceftriaxone (30µg), Cefotaxime (30µg) were placed on the surface of the Mueller Hinton agar plate. It was then incubated at 37^0C for 24hr and the radial zones of inhibition were taken. Any organism resistant to 3rd generation cephalosporins (ceftazidime, ceftriaxone, cefotaxime) and sensitive to 2nd generation cephalosporins (cefoxitin and imipenem) were subjected to ESβL studies.

Phenotypic Detection of ESβL Using Double Disc Synergy Test (DDST)

DDST, synergy test was done using amoxicillin-clavulanate disc antibiotic (20µg, 10µg) and 30µg of cefotaxime and ceftazidime antibiotics. An amoxicillin-clavulanate disc was placed on the centre of a Prepared Mueller-Hinton plate and cefotaxime and ceftazidime were placed 15mm apart from the centre disc (amoxicillin-clavulanate disc (20 µg and 10 µg). The test organisms were considered ESβL producers (DDST test positive) if the zone size around the test antibiotic disc increased from 5mm and above towards the amoxicillin-clavulanate disc.

Results

The results of the present study are presented below. Out of the 600 urine samples collected from primary school children (300) and secondary school children (300). 96 (16 %) of *Klebsiella pneumoniae* were isolated, 29 (9.6 %) urine samples from primary school children were *Klebsiella pneumoniae* positive while 67 (23.3 %) urine samples from secondary school children were positive for *K. pneumoniae.* The result of DDST revealed that out of 96 isolates of *K. pneumoniae* screened for the presence of extended-spectrum Beta-lactamase enzyme (ESβL), 17 (17.7 %) were positive for this enzyme where 5 (29.4 %) of

ESβL-producing enzymes were detected from primary school children and 12 (70.5 %) were detected from secondary school children with 23.5 % and 76.5 % from male and female respectively (Table 1).

Table 1: Distribution of ESβL-producing *Klebsiella pneumonia* isolated from primary and secondary school students

Characteristics	**Total Isolates N= 96 (%)**	**ESβL-Positive(N=17)**	**ESβL-Negative (N=79)**
Primary school c hildren	29(4.8)	5(5.2)	24(30.4)
Secondary school children	67(11.2)	12(12.5)	55(69.6)
Total	**96(16)**	**17(17.7)**	**79(82.3)**
Sex Group			
Male	38(39.6)	4(23.5)	34(43)
Female	58(60.4)	13(76.5)	45(57)
Total	**96(100)**	**17(100)**	**79(100)**

The result of the antimicrobial susceptibility test of the organisms to Gram-negative antibiotics and single Beta-lactam antibiotics is presented in Figure 1 below. The test organisms were susceptible to the fluoroquinolones: gatifloxacin 68 (70.8 %), ofloxacin 65 (67.7 %), pefloxacin 65 (67.7 %), ciprofloxacin 71 (74.9 %), nitrofurantoin 87 (90.6 %) while they were resistant to tetracycline 33 (37.5 %). For beta-lactam antibiotics, the test organism was susceptible to ceftazidime 67 (69.8 %), imipenem 81 (84.4 %), and cefoxitin 77 (80.3 %) but showed resistance to ceftriaxone 32 (33.3 %) and cefotaxime 26 (27.1 %) (Figure 1).

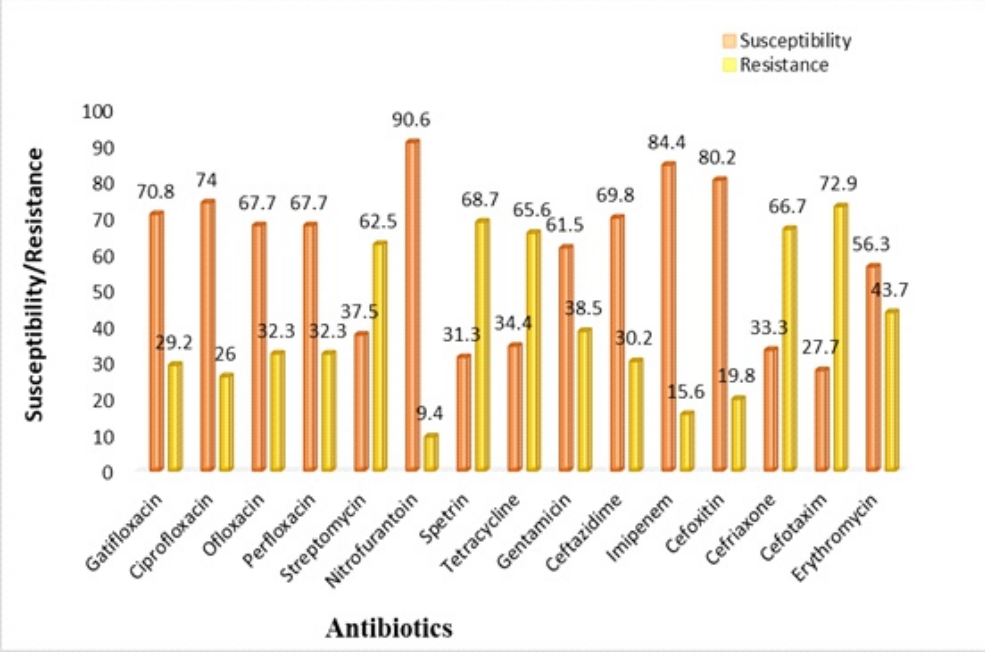

Figure 1: Percentage susceptibility and resistant patterns of *Klebsiella pneumoniae* against various classes of antibiotics

The MIC results of ESβL-producing organisms are presented in Tables 2 and 3. Strain 11 has relatively low MICs for Ciprofloxacin (1.56 µg/ml) and Gatifloxacin (6.25 µg/ml. However, it shows high MIC values for Perfloxacin and Cefoxitim (250µg/ml) and Septrin (50µg/ml). Strain 36 shows strong susceptibility to Septrin (0.78 µg/mL) but reduced susceptibility to Ofloxacin (62.5 µg/mL). Strain 40 has a low MIC for Erythromycin (0.17 µg/mL), indicating strong susceptibility, but higher MICs for other antibiotics like Streptomycin (250 µg/mL) and Pefloxacin (15.6 µg/mL). Strain 45 demonstrates notable resistance to Ciprofloxacin (125 µg/mL) and Streptomycin (500 µg/mL) but lower MICs for Gentamicin (3.9 µg/mL) and Cefoxitin (12.5 µg/mL). Strain 92 shows generally high MICs across several antibiotics, such as Gatifloxacin (50 µg/mL), Streptomycin (500 µg/mL), and Cefotazidime (250 µg/mL), suggesting potential resistance (Table 2).

Table 2: Minimum inhibitory concentration (µg/ml) of ESβL-positive *Klebsiella pneumoniae* from primary school children

	Antibiotics Name														
Org No.	**Gat**	**Cip**	**Ofl**	**Per**	**Strep**	**Nit**	**Sep**	**Tet**	**Gen**	**Cef**	**Imi**	**Cefo**	**Ceftr**	**Ceft**	**Ery**
11	6.25	1.56	7.81	250	125	50	50	50	31.2	15.6	1.95	250	250	280	50
36	12.5	3.12	62.5	1.95	125	50	0.78	50	125	125	7.81	1.95	16.2	250	50
40	16.2	31.2	15.6	15.6	250	12.5	50	50	15.6	31.2	31.2	250	31.2	125	0.17
45	0.39	125	15.6	7.81	500	50	50	0.78	3.9	0.78	12.5	12.5	50	1.95	0.78
92	50	62.5	62.5	250	500	50	50	50	125	250	50	50	50	250	50

Key: *Gat = Gatifloxacin, Cip = Ciprofloxacin, Ofl = Ofloxacin Per = Perfloxacin Strep= Streptomycin, Nit = Nitofurantoin Sep = Septrin Tet = Tetracycline, Gent = Gentamicin, Cef = Cefotazidime Imi = Imipenem, Cefo = Cefoxitim, Ceftr = Ceftriaxone Ceft ceftaxidime =, Ery = Erythromycin*

Strain 10 shows high resistance to several antibiotics (e.g., Ciprofloxacin at 50 µg/mL, Cefotaxime at 250 µg/mL) but is more susceptible to Gatifloxacin (0.78 µg/mL) and Imipenem (25 µg/mL). Strain 18 exhibits moderate resistance with high MICs for some antibiotics (50 µg/mL for Ciprofloxacin and 500 µg/mL for Pefloxacin) but is more effectively treated with Gentamicin (0.39 µg/mL) and Imipenem (6.25 µg/mL). Strain 46 has lower MICs for Gatifloxacin (25 µg/mL) and Imipenem (0.39 µg/mL), indicating susceptibility, but shows resistance to other drugs. Strains 53 and 99 show high resistance to many antibiotics but remain susceptible to Gatifloxacin and Gentamicin (Gatifloxacin (0.39 µg/mL) and Gentamicin (0.78 µg/mL)) (Table 3).

Table 3: Minimum inhibitory concentration (μg/ml) of ESβL positive *Klebsiella pneumoniae* from secondary school children

	Antibiotics Name														
Org No.	**Gat**	**Cip**	**Ofl**	**Per**	**Strip**	**Nit**	**Sep**	**Tet**	**Gen**	**Cef**	**Imi**	**Cefo**	**Ceftr**	**Ceft**	**Ery**
10	0.78	50	52.5	250	500	50	50	50	62.5	250	25	250	15.6	125	50
18	0.39	50	15.6	125	500	50	50	12.5	62.5	0.39	6.25	62.5	250	50	50
37	3.12	50	31.3	1.95	250	50	50	50	125	62.5	62.5	250	31.2	50	12.5
46	25	1.56	3.9	6.25	125	6.25	50	50	125	12.5	0.39	250	250	125	50
53	25	0.39	7.81	7.81	125	0.39	50	50	125	250	0.78	250	125	125	50
76	50	25	62.5	125	500	25	50	50	15.6	0.78	6.25	250	62.5	0.78	0.78
77	3.12	0.78	62.5	250	500	62.5	50	50	500	250	6.25	250	31.2	50	50
78	25	6.25	125	250	62.5	3.12	50	50	62.5	25	31.2	50	250	50	50
80	50	25	125	3.12	500	50	50	12.5	3.9	50	15.6	50	250	250	50
83	6.25	50	3.9	250	12.5	0.78	50	0.78	125	50	0.78	50	62.5	50	50
91	3.12	50	7.81	62.5	125	25	50	50	125	50	0.78	250	250	0.78	50
99	0.39	50	125	125	125	12.5	50	50	125	50	62.5	50	50	50	50

Key: *Gat = Gatifloxacin, Cip = Ciprofloxacin, Ofl = Ofloxacin Per = Perfloxacin Strep= Streptomycin, Nit = Nitofurantoin Sep = Septrin Tet = Tetracycline, Gent = Gentamicin, Cef = Cefotazidime Imi = Imipenem, Cefo = Cefoxitim, Ceftr = Ceftriaxone Ceft = ceftaxidime =, Ery = Erythromycin.*

Discussions

This research documented the presence of ESβL-producing *Klebsiella pneumoniae* in primary and secondary school children. In the past, bacteria that produced ESβL were considered to be only found in healthcare-associated infections. However, recently, ESβL-producing Enterobacteriaceae isolates have been observed in individuals who are not admitted or attending hospital or presenting any clinical signs of any disease [7]. Analysis of urine samples from these children revealed low levels of carriers of ESβL-producing *Klebsiella pneumoniae*, which were resistant to multiple drugs. ESβLs are commonly found in Gram-negative bacteria, especially *Klebsiella pneumoniae* and *Escherichia coli*, with a higher prevalence in hospital settings such as intensive care units, surgical wards, pediatrics, neonatal units, rehabilitation, and oncology wards[19].

In the present study we focus on ESβL prevalence in non-hospital isolates i.e., individuals who are not admitted or attending hospital or presenting any clinical signs of any disease (community isolates) and our findings reveal a low prevalence of ESβL of 17(17.7 %). This is lower than the 23.0 % prevalence rate reported by Mengistu et *al* for ESβL-producing *Escherichia coli and Klebsiella pneumonia* in Southwest Ethiopia, [7] and 26.9 % reported by Easter and Smart, in research, conducted in River State, Nigeria on community-acquired ESβL-producing *Klebsiella* [20] but higher than 14.3 % reported by Siraji *et al* [21]in Southwest Ethiopia. The reason for the lower prevalence observed in our study could be due to the inclusion of only one single specimen for apparently healthy individuals in the community and also because hospital-acquired isolates are more likely ESβL producers [7]. Albeit, the findings of this study are in agreement with the confirmed reports that ESβL enzymes are mostly plasmid or chromosomally mediated enzymes that harbour genes for resistance to other antimicrobial agents such as fluoroquinolones, and aminoglycosides thereby making them multi-drug resistant [22]. Our findings showed that the test organisms were susceptible to the fluoroquinolones (ofloxacin 67.7 %, gatifloxacin 70.8 %) to carbapenems (imipenem 84.4 %) to nitrofurantoin 90.0 % in contrast to resistance recorded in third-generation cephalosporins (ceftriaxone 33.3 %, cefotaxime 27.1 %) also to

streptomycin 37.5 %, tetracycline 34.4 %, sulfamethoxazole and trimethoprim 31.3 %. This is not in total agreement with the findings of Easter and Smart [20] where they reported 96.9 % susceptibility to imipenem and 100 % to meropenem and a contrast susceptibility of cephalosporins (ceftazidime (66.3 %), cefotaxim (65.2 %), ceftriaxone (63.0 %)) to the present study. The resistance to cephalosporine reported in this present study could be a result of its high use resulting in abuse of the drug in the area of study.

The low prevalence rate observed in our study showed that this organism has a low spread. Out of 17 (17.7 %) prevalence observed 5(29.4 %) were detected from primary school children while 12(70.6 %) were detected from secondary school children. This finding is in line with resistance data among clinical isolates and susceptibility of the ESβL-producing *Klebsiella pneumoniae* to the fluoroquinolones isn't out of place because fluoroquinolones aren't utilized in young children [23]. The susceptibility of test organisms to nitrofurantoin (90.60 %) isn't surprising because this drug is understood to be effective against urinary tract infections as a result of its high-level serum concentration within a brief period in the bladder after administration [24.] Results of the study also highlights the need for targeted antibiotic treatment. Imipenem and Gatifloxacin appear effective for many strains, while Perfloxacin and Septrin may be less useful due to higher resistance levels. This analysis will help guide treatment decisions and antibiotic stewardship. Imipenem generally maintains lower MICs but shows some elevated values in specific strains, indicating potential early stages of resistance development. This reinforces the importance of using carbapenems judiciously to prevent widespread development of resistance. ESβL isolates showed high MIC values against different classes of antibiotics within the range of 50-250 µg/ml, this high level of resistance observed could be due to the change in the active site of the present beta-lactamase which confers extra substrate profile to enzyme thus makes them resistant to other antibiotics which their parent strains are susceptible [24].

Prevalence of ESβL in two major Missionary hospitals in Abakaliki Ebonyi State (St. Patrick and Mile 4 hospital) has been reported by some researchers where findings revealed a high prevalence of *E. coli* (44.4 %) expressing ESβL enzymes and were multi-drug resistant [5]. Based on the previous and present findings, it is now established that ESβL enzymes are present in both hospital and non-hospital environments in Abakaliki Ebonyi State. These findings should be taken very seriously by health workers since some of the volunteers were classmates and friends, the possibility of person-to-person transmission of ESβL-producing bacteria or their resistant determinant could be possible and if not controlled it will spread to a larger population of people in the community thereby causing serious health problem when the immune system of this people is compromised, therefore we are strongly advocating for a more comprehensive epidemiological studies.

In the home and school environments relations and friends are in danger of becoming colonized or infected with ESβL-producing organisms [25]. Since the bulk tract infection involves self-infection from the gut flora, the organism can easily spread within the healthy population. *Klebsiella pneumoniae* is an important hospital/community-acquired pathogen [23] that is usually susceptible to extended-spectrum cephalosporins, however, strains resistant to these antibiotics mediated by extended-spectrum beta-lactamases have now spread worldwide. ESβLs producing *Klebsiella pneumoniae* have emerged due to selective pressure as a result of misuse and underuse of cephalosporins [25]. One of the good concerns is that these strains are spreading not only in hospitals but also in the community and as it is carried in the urine there is the possibility that they will be present in the faeces of healthy individuals.

The multidrug resistance nature of these isolates may be explained by the fact that ESβLs are plasmid-mediated enzymes that carry multi-resistant genes by plasmid, transposon, and integron, and also, they are readily transferred to other bacteria, not necessarily of the same species, and bacteria with multiple resistances to antibiotics are widely distributed in hospitals and isolated from the community as well [25,26]. This fact supported by surveys from Canada [27] and Spain [28] has illustrated an alarming trend of associated resistance among ESβL-producing organisms isolated from the community site. Thus, our study results will support the fact that ESβL producers confer high levels of resistance to third-generation cephalosporins and other non-β lactam groups of antibiotics.

Conclusion

This study found that *Klebsiella pneumoniae* bacteria, which produce an enzyme called ESβL, can be present in the urine of school-aged children who are individuals not admitted or attending hospital or presenting any clinical signs of any disease. The bacteria isolates showed notable resistance to multiple antibiotics, including third-generation cephalosporins and carbapenems. This

underscores the critical need for routine surveillance and antimicrobial susceptibility testing in community settings to inform appropriate treatment strategies. It is also important to monitor and limit the use of certain antibiotics, conduct regular surveillance of antibiotic resistance patterns, and reduce the unnecessary use of antibiotics to address some of the problems associated with ESβLs in the community.

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