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Detection of multidrug resistance *E. coli* isolated from patients with UTI in FMC Birnin, Kebbi

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ABSTRACT

Aim: This study sought to ascertain the prevalence of multidrug resistant strains among *E. coli* isolates responsible for urinary tract infections (UTIs) that were resistant to frequently used antimicrobial drugs. **Methods:** Thirty (30) urine samples were collected from Federal Medical Center (FMC) patients who may have had UTIs in Medical Center Birnin Kebbi. Regular biochemical tests were used to identify all isolates, and testing for antibiotic susceptibility were performed using disc diffusion method. **Results:** The majority of the isolates were aztreonam and cefotaxime resistant. Cefotaxime and aztreonam resistance rates overall were 81% and 82%, respectively. Almost all isolates were susceptible to ciprofloxacin and tigecycline, with respective resistance rates of 17% and 10%. One in seventeen isolates of *E. coli* were multidrug resistance (MDR). **Conclusion:** According to our findings, only a small percentage of the *E. coli* isolates included in this investigation were MDR. It is strongly advised that antibiotic prescriptions be monitored in accordance with the recommendations. Both in clinical settings and in the population at large, antibiotic use should be closely monitored. In order to reduce infections, infection prevention and control are essential in all healthcare settings.

Introduction

Escherichia coli is a Gram-negative pathogen that is rod-shaped, facultatively anaerobic, non-sporulating, motile, and has a high rate of worldwide spread. It is possible to isolate it from clinical, veterinary, and environmental sources. The majority of clinical and environmental mediated disorders are caused by certain strains of *E. coli*. *Escherichia coli* strains are widespread bacteria that live in the human gastrointestinal tract. Although they are commensals, they can cause a wide range of illnesses, including meningitis, diarrhea, septicemia, and urinary tract infections (UTIs) [1].

A number of antibiotic categories including cephalosporins, carbapenem, aminoglycosides, fluoroquinolones are used in the treatment of UTI caused by *E. coli*. The alarming increase in the rate at which these strains acquire antibiotic resistance genes has limited therapeutic options especially for UTIs for which extensive use of antibiotics has been witnessed in both community and hospital settings [1,2]. As long as they do not acquire genetic components expressing harmful proteins, their innocuous strains can continue to exist as commensals. Virulence variables could ultimately lead to these disorders [3,4]. The establishment of multidrug resistance (MDR) is a natural process, but

improper antibiotic use, unsanitary settings, improper food handling, and superbug infection prevention and control procedures have all contributed to its creation and encourage its spread. Growing multidrug-resistant microorganisms pose a threat to our ability to treat these types of illnesses. These germs are particularly resistant to the widely used antimicrobials [5]. Multidrug resistance is defined as non-susceptibility to at least one agent in three or more antimicrobial categories while extensively drug resistance is non-susceptibility to at least one agent in all but two or fewer antimicrobial categories

One of the greatest worldwide health issues, UTI affects almost 150 million people annually and responsible for approximately 8.1 million annual visits to healthcare providers [6-8]. Untreated UTIs frequently result in major consequences that increase treatment costs and death [9,10]. Resistance has developed among different strains of bacteria as a result of the use of antimicrobial medications [11]. The most prevalent bacterial infections contracted in hospitals and the community are UTIs [12]. The majority of uropathogens originate in the gut microflora of the host and enter the bladder through the urethra, making *E. coli* the most prevalent uropathogen [13]. Urinary tract infection (UTI) treatment has increased bacterial resistance to commonly used antibiotics, which possess a significant financial and health burden on the society [14]. *Escherichia coli* could develop antibiotic resistance by efflux pumps, antibiotic-inactivating enzymes, alterations to permeability or targets, acquired plasmids encoding -lactamases, or through enzymes that modify aminoglycosides [15]. There is, however, no information on the detection of multidrug-resistant *E. coli* from UTI in FMC. Therefore, this study was carried out to investigate the multidrug resistance in *E. coli* isolated from patients with UTIs in Federal Medical Center Birnin Kebbi, Nigeria

Materials and methods

Isolation and identification of *Escherichia coli*

A total of thirty urine samples of UTI patients comprising both females and males between 18 to 60 years old were obtained at the FMC, Birnin Kebbi in Nigeria. The urine samples were inoculated into nutrient broth and incubated for 24hrs and further cultured onto MacConkey agar (Oxoid) and Eosin methylene blue (EMB). The plates were then streaked with a calibrated loop and incubated at

37°C for 18–24 hours to allow for bacterial growth. Gram staining, citrate utilization, lactose fermentation, motility, ability to generate indole, and lysine decarboxylation were among the conventional tests used to identify *E. coli* [16].

Determination of antibiotic susceptibility of *E. coli* isolates

According to the European Committee on antimicrobial susceptibility testing (EUCAST), 17 *E. coli* isolates were tested for antibiotic susceptibilities against 4 different antibiotic discs (Oxoid, UK) using the Kirby-Bauer disk diffusion test on Mueller Hinton agar [17]. The following four antibiotic classes were employed: ciprofloxacin (fluoroquinolone), cefotaxime (cephalosporins), tigecycline (tetracycline), and aztreonam (monobactams). In 5ml of sterile physiological saline, discrete colonies of isolates on nutritional agar plates were emulsified, and the turbidity was adjusted to 0.5McFarland standard (about a 0.5) 1.5×10^8 cells per milliliter. To ensure equal dispersion and confluent development, the standardized suspension was inoculated on Muller Hinton agar using a sterile swab. Using sterile forceps, the antibiotic disc of the different antibiotics was aseptically put on the dried, inoculated agar surface and incubated for 18 hours at 37 °C. Based on the EUCAST, 2021 criteria, inhibition zones were classified as resistant, moderate, or susceptible [18], MDR was assessed as resistance to at least three antimicrobial classes.

Statistical analysis

Statistical tools such as diagrams, Pie chart and bar chart were used for the descriptive and inferential analysis using the excel spread sheet.

Results

Isolation and identification of *E. Coli*

Out of the 30-urine samples collected, 17 were confirmed to be *E. coli* isolates. Age between 18-30 has the highest percentage of 41.1% and 51-60 has the list percentage of 5.8% as shown in **table (1)** below. The UTI's prevalence rate was high in females which were 64.7% as compared to males which were 35.3% as shown in **figure (1)**.

Antimicrobial susceptibility of *E. coli* isolates

All the seventeen confirmed isolates were tested with four different antibiotics (ciprofloxacin, cefotaxime, aztreonam and tigecycline) which belongs to different classes and categories of antibiotics. From the test conducted, 82.3% of all the

isolates were resistant to aztreonam followed by cefotaxime with 81.5%. Tigecycline and ciprofloxacin showed least resistance with 10% and

17.7%. Out of the 17 isolates tested 11.7% were multidrug resistance as shown in **figure (2)** below.

Table 1. Isolation and identification of *E. coli* isolates from patients with suspected UTI.

No of samples collected	Age	No. of <i>E.coli</i> isolated	% of isolates
12	18-30	7	41.1
10	31-40	5	29.4
5	41-50	4	23.5
3	51-60	1	5.8
30	18-60	17	56.6

Figure 1. Percentage distribution of isolates based on gender.

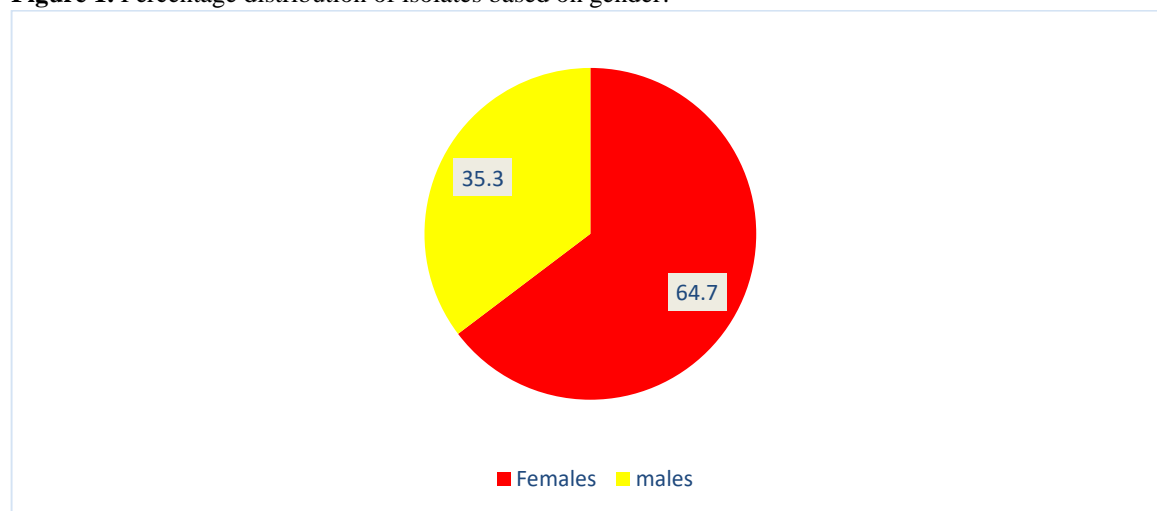
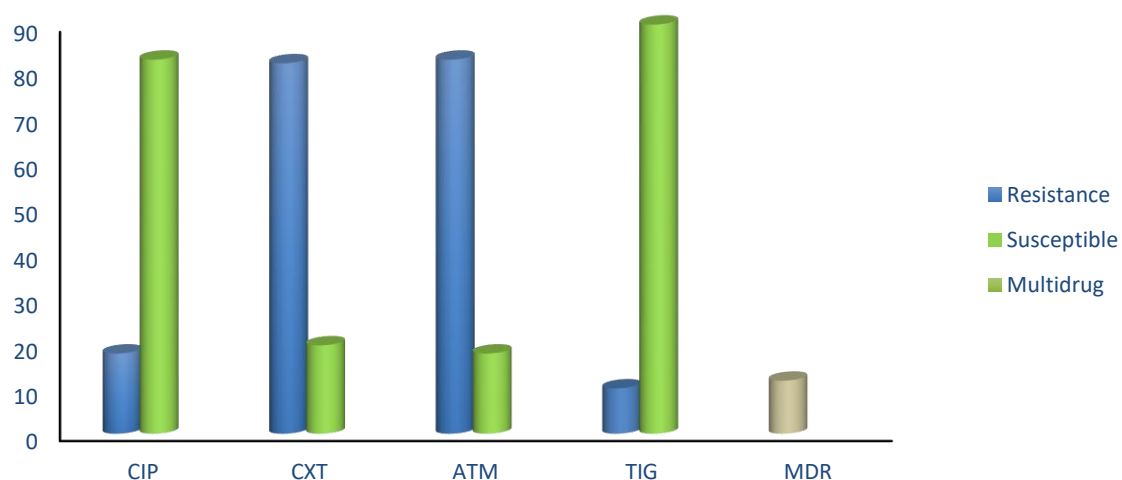


Figure 2. Antimicrobial susceptibility of *Escherichia coli* isolates.



Discussion

Escherichia coli strains and the escalating antimicrobial resistance endanger the ability to treat UTIs effectively, which increases morbidity, lengthens hospital stays, raises treatment costs, and increases disease-related death. In our study, from 30 urine samples, we detected significant growth of *E. coli* 56.6% (n=17) of the clinical samples. In accordance with global trends, our results reveal higher prevalence of UTIs in female patients than in males [19, 20]. The prevalence rate reported by **Islam et al.** [21] was about 38.2%, the percentage rate of the isolated sample is in accordance with reports by **Farzana et al.**, **Gad et al.** and **Thiraviam et al.** [22-24] who reported 54.6%, 67%, and 53%, respectively. Both in underdeveloped and industrialized nations, the resistance of bacteria that cause UTI to frequently administered antibiotics is rising [25]. The UTI-associated *E. coli* bacteria tested for antimicrobial susceptibility in this study had extremely high levels of resistance to cefotaxime and aztreonam. This is in contrast to a report by **Abujnah et al.** [26], which claimed that aztreonam was 58% effective, and is consistent with **Salah et al.** [27] which claimed that cefotaxime was 82.4% effective. This commonly reported observation may be the result of its widespread usage in the management of uncomplicated UTIs, however the high prevalence of bacterial resistance has now limited its effectiveness [28, 29]. The *E. coli* identified in this study may respond very well to ciprofloxacin and tigecycline, which is consistent with earlier findings [30,31]. Our findings reveal the effectiveness of ciprofloxacin against *E. coli* which is higher compare to a finding by **Nguyen et al.** [32]. Due to the rise of pathogenic isolates that are multidrug resistant, the effectiveness of treating pathogenic bacteria with antibiotics has recently declined [33]. Considerations to keep in mind while selecting an appropriate antibacterial for the treatment of UTIs. The study has a number of restrictions. Only 30 samples were used in this single-site analysis. There should be a wider representation of the population and more samples.

Conclusion

This study highlighted the existence of resistance in *E. coli* isolated from UTIs against a number of first line antibiotics. A wider population-wide survey and ongoing monitoring of antibiotic resistance and MDR should be put in place to guide local prescription recommendations. It is also

extremely needful to strengthen strict compliance to antibiotic stewardship and enforcement of infection control practices in all our health institutions as a means of controlling the increasing spread of MDR bacteria.

Ethics approval and consent to participate

This study obtained approval from Medical Ethics Committee at the Federal Medical Center Birnin Kebbi. Written informed consent was provided by the patient to allow the case details to be published.

Conflict of interest

The authors declare that they have no conflict of interest

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