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Prevalence and Multi-Drug Resistance Patterns of Uropathogenic *E.coli* isolated from Women Patients in Kirkuk city, Iraq

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ABSTRACT

Background and Aim: *E.coli* is a member of the Enterobacteriaceae family and gram-negative bacilli. Many genera of bacteria can be caused urinary tract infections. Uropathogenic *E.coli* is responsible for 80 - 90% of urinary tract infections around the globe. This study determined the prevalence rate of uropathogenic E.coli isolated from Women Patients and studied the multidrug resistance patterns of these isolates in Kirkuk city, Iraq.

Materials and Methods: The collection of 200 Urine samples from women patients of different ages was achieved from January to May 2022 at the women's and children's Hospital in Kirkuk city, Iraq. Then inoculated on, Nutrient, MacConkey, and blood agar and incubated for 24 hours at 37°C. *E.coli* colonies were identified by culturing and biochemical tests, then antibiotic susceptibility tests of these isolates were done.

Results: The prevalence of bacterial's positive growth was 132 (66%), distributed as the following: *E.coli* 47(35.6%), *S.aureus* 37 (28.03%), *Staphylococcus spp.* 9 (6.81), *Proteus mirabilis* 9 (6.81), *Klebsiella sp.* 9(6.81), *Pseudomonas aeruginosa* 7(5.3%), *Streptococcus spp.* 7(5.3%), *Acinetobacter baumannii* 4(3%) and *shigella spp.* 3(2.27%). Most of *E.coli* isolates were isolated from women patients with age group 18-38 years. Meropenem showed the highest effect with no resistant *E. coli* isolates, followed by Amikacin, Ciprofloxacin, Azithromycin, Levofloxacin, Trimethoprim and Nitrofurantoin (10.63%,19.14%,19.14%, 31.91%, 38.29% and 38.29)respectively**.** In contrast to Augmentin, which revealed no effect towards these isolates with 100% resistance, followed by Ceftazidime, Rifampicin and Ceftriaxone (78.72%, 72.34%and 59.57%), respectively**.** The current data revealed that the isolates had multidrug resistance to four, five, six, and seven antimicrobial classes: 18(38.29%), 15(31.91%), 9(19.14%), and 5(10.63%) of *E. coli* isolates, respectively.

Conclusion: The sensitivity of all *E. coli* isolates towards meropenem calls for attention that the overuse/misuse of this antibiotic will be caused selection pressure and increase the rate of resistance.

Keywords: UTI, Uropathogenic *E.coli*, Antibiotic sensitivity, Multi-drug resistant, Kirkuk, Iraq

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1. Introduction

E.coli is a member of Enterobacteriaceae family and gram-negative bacilli. Some strains of it cause diarrhea, food poisoning and urinary tract infections. Many genera of bacteria can cause urinary tract infections. In fact, uropathogenic *E.coli* is responsible for 80 - 90% of urinary tract infections globally **(1)**. Urinary tract infections (UTI) are a result of bacterial colonization to the urinary system and occur with high frequency in females of all age groups. *E. coli* is considered the most significant pathogen isolated from UTIs patients. Moderate or severe dysuria is considered the most common symptom of UTIs. In addition to fever, flank pain, or nausea and vomiting **(2)**.

Urinary tract infections are more significant and common in women because of the short urethra of women which causes more easy traveling of microorganisms into the bladder and the inoculation of microorganisms into the bladder is increased by the sexual activities and delayed post-coital urination with using of the diaphragm as a birth control measures are aid the recurrent UTIs in women **(3, 4)**. The risk of recurrent urinary tract infections increases if the symptoms continue for at least 7 days **(3)**. In addition, the high resistance rate towards the commonly used antibiotics might also play an important role in causing recurrent and complicated UTI **(5)**.

This study determined the prevalence rate of uropathogenic E.coli isolated from Women Patients and studied the multidrug resistance patterns of these isolates in Kirkuk city, Iraq.

2. Materials and Methods

Sample Collection

Collection of 200 Urine samples from women of different ages with symptoms of UTI were achieved over a period from January to May 2022 at women's and children's Hospital in Kirkuk city, Iraq. Then inoculated on Nutrient, MacConkey, and blood agar and incubated at 37o C for 24 hours. The presence of $\geq 10^5$ colonies was revealed as a UTIs (5). Identification was proceeded by following the guidelines of standard biochemical tests.

Antimicrobial Resistance

Antimicrobial resistance was proceeded by the disk diffusion method according to the guidelines of CLSI **(6)**. Antibiotics were used: Augmentin(10µg); trimethoprim- sulfamethoxazole (SXT: 1.25/23.75µg); levofloxacin (LEV:5µg); ceftazidime (CAZ: 30µg); ceftriaxone (CRO:30µg); meropenem (MEM:10µg); azithromycin (Azi:15µg); amikacin(AK:30µg); refampicin(RA:30µg); ciprofloxacin(CIP:5µg); and nitrofurantoin(F:300µg). Their resistance detected Multi Drug Resistant of Uropathogenic E.coli isolates towards three or more antibiotic classes **(7, 8)**.

Data Analysis

Microsoft Excel 2010 was used for the statistical analysis of our results.

3. Results

This study reported 132(66%) positive bacterial growth from 200 women patients' urine samples as mentioned below in Figure.1.

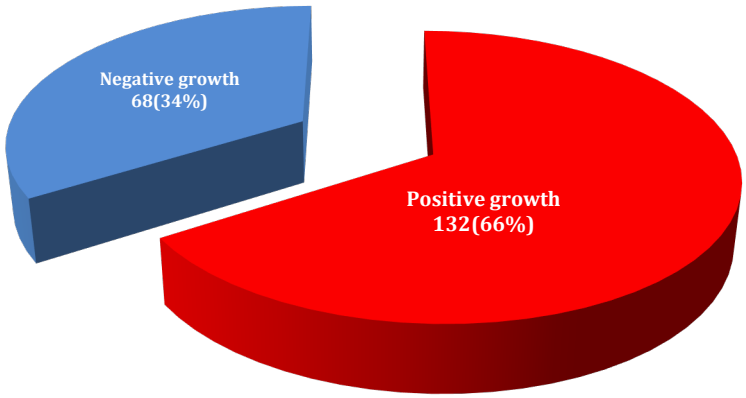

Figure 1. Prevalence of positive growth among total women urine samples.

Distribution of UTI bacterial isolates from total positive growth was *E.coli* 47(35.6%), *S.aureus* 37(28.03%), *Staphylococcus spp.* 9(6.81), *Proteus mirabilis* 9(6.81), *Klebsiella sp.* 9(6.81), *Pseudomonas aeruginosa* 7(5.3%), *Streptococcus spp.* 7(5.3%), *Acinetobacter baumannii* 4(3%) and *shigella spp.* 3(2.27%). As mentioned below in table 1.

The *E.coli isolates* rate among women urine samples was 47 (35.6%) isolates, as mentioned below in (Figure 2).

Most of *E. coli* isolates (n=26; 55.31%) were isolated from women patients in age group 18-38 years old (Figure 3).

Table 1. Distribution of UTI bacterial isolates from total positive growth

UTI bacterial isolates	NO. Percentage(%)
E.coli	47 (35.6%)
S.aureus	37(28.03%)
Staphylococcus spp.	9(6.81%)
Proteus mirabilis.	9(6.81%)
Klebsiella spp.	9(6.81%)
Pseudomonas aeruginosa.	7(5.3%)
Streptococcus spp.	7(5.3%)
Acinetobacter baumannii.	4(3%)
Shigella spp.	3(2.27%)
Total	132(100%)

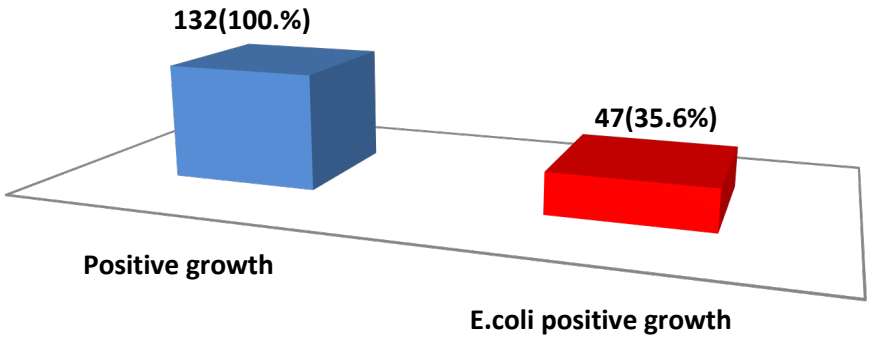

Figure 2. Prevalence of *E.coli* in among positive growth women urine samples.

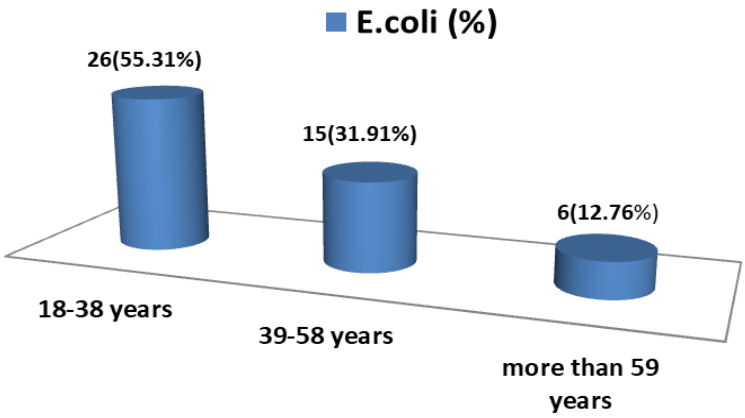

Figure 3. The *E.coli* isolates rate according to women patients' age group

E.coli isolates were showed 100% resistance towards Augmentin. In contrast, these isolates showed no resistance to meropenem (0%) and reported various resistance towards various antibiotics as mentioned in (Figure 4).

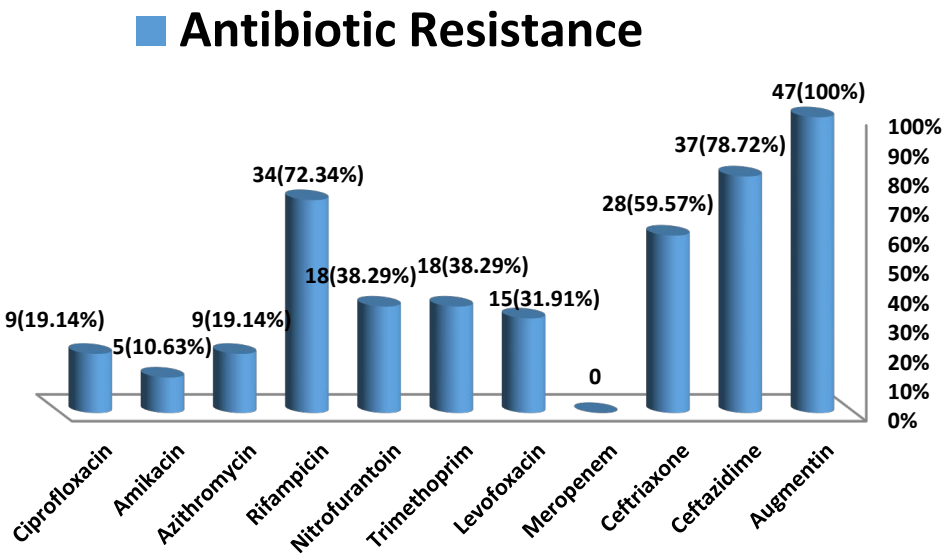

Figure 4. Resistance pattern of *E.coli* isolates.

The MDR patterns of Uropathogenic *E.coli* isolates were classified into various groups (Types 1-4). Antibiotyping of Type 1 shows resistance towards all seven classes of antibacterials used in current study, while the Type 4 revealed resistance towards 4 classes, as shown below in table2.

Table2. Multidrug resistance pattern of the *E.coli* isolates.

Type	No. of classes	No. of *E.coli* isolates (%)	Resistance of antibiotics
1	7	5(10.63%)	AMC,RA,CAZ,CRO,CIP,F,AK,SXT,LEV,AZI.
2	6	9(19.14%)	AMC,RA ,CAZ,CRO,CIP,F, SXT,LEV,AZI
3	5	15(31.91%)	AMC,RA ,CAZ,CRO,F, SXT,LEV.
4	4	18(38.29%)	AMC,RA ,CAZ,CRO,F, SXT.

4. Discussion

UTI is one of the most prevalent infections globally. Although every person is susceptible to UTIs, some persons, such as females, are more effectible to these infections because of their physiological and anatomical features **(5, 8)**.

The prevalence of bacterial positive growth was 132(66%), distributed as the following: *E.coli* 47(35.6%), *S.aureus* 37(28.03%), *Staphylococcus spp.* 9(6.81), *Proteus mirabilis* 9(6.81), *Klebsiella sp.* 9(6.81), *Pseudomonas aeruginosa* 7(5.3%), *Streptococcus spp.* 7(5.3%), *Acinetobacter baumannii* 4(3%) and *shigella spp.* 3(2.27%), these findings were close to Nahab *et al*. in 2022 and Assafi *et al.* in 2022 [10,17]. *E. coli* was the common cause of UTI (35.6%), while other studies revealed such results as 31.8% and 38.1% **(9, 10)**. The variations in the rates among different studies might belong to many points, such as differences in geographical location and the hygienic culture of the studied society **(7, 11-13)**. *E. coli* isolates were obtained from women in the age group 18-38 years with the highest rate of 55.31% (Figure3); this was agreed with the finding of Nahab *et al*. in 2022 **(10)** because of the medical fact of women sexual activity and reproductive activity are increased during these periods; thus causing infection by inoculating the microorganisms into the urinary tract **(10, 14-18)**.

Meropenem showed the highest effect with no resistant *E. coli* isolates, followed by Amikacin, Ciprofloxacin, Azithromycin, Levofloxacin, Trimethoprim and Nitrofurantoin (10.63%, 19.14%, 19.14%, 31.91%, 38.29% and 38.29%%) respectively as mentioned in (Figure 4), these findings were closed to Al-Guranie and Al-Mayahie in 2020 and Assafi *et al* in 2022 **(19, 20)**. In contrast, Augmentin revealed no effect towards these isolates with 100% resistance, followed by Ceftazidime, Rifampicin and Ceftriaxone (78.72%, 72.34%and 59.57%) respectively (Figure 4). These results were close to many studies **(15, 16)**.

The range of exposure the antibiotics by the studied population with their hygienic culture is the major reason for the differences in the prevalence rate of antibiotic resistance among various studies **(7, 11-13, 21)**.

The current study revealed that *E.coli* isolates were multidrug resistant to four, five, six and seven antibacterial classes: 18(38.29%), 15(31.91%), 9(19.14%), and 5(10.63%) of *E. coli* isolates, respectively (Table2). Five *E.coli* isolates (type1) showed the highest MDR rate (10.63%) against all 7 classes of antimicrobials drugs that were used in this study, while 19.14% (type2), 31.91% (type3) and 38.29% (type4) of the isolates were MDR resistant towards 6, 5 and 4 classes as mentioned in (Table2). These findings were close to the findings of Al-Guranie and Al-Mayahie in 2020 **(19)**.

Several reasons are participated in increasing MDR E.coli strains in this study such as self-prescription of antibiotics which lead to overuse/misuse of these medications; careless usage of antimicrobial drugs is the most critical reason for developing MDR **(22-24)**. To decrease MDR, Al-Hilali **(22)** and Lee et al. **(25)** revealed that the selection of antibiotic for each patient should take into consideration: person and population patterns of antibiotic resistance, the severity of the patient disease, and the potential side effects, which associated with using of antimicrobial drugs. Therefore, using an appropriate antimicrobial drug is significant and essential for any program to decrease the appearance of drug-resistant bacteria and spread them in hospitals **(26-29)**.

5. Conclusion

Periodic surveillance of antibiotic resistance is essential to monitor the variations in the antibiotic sensitivity pattern in any population.

The sensitivity of all *E. coli* isolates towards meropenem calls for attention that the overuse/misuse of this antibiotic will cause selection pressure and increase the rate of resistance. Therefore, education programs and awareness are important and necessary for the accurate diagnosis of diseases, the right selection, and the wise use of available antibacterial drugs. Thus, periodically monitoring of antibiotic susceptibility pattern of UPEC periodically will guide the wise use of antibacterial drugs and help decrease the bacterial vigor of resistance.

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Conflict of Interest

The authors declare any conflict of interest.

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