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INCIDENCE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF *ESCHERICHIA COLI* CAUSING COMMUNITY-ACQUIRED URINARY TRACT INFECTION IN TIARET PROVINCE, WESTERN ALGERIA: RETROSPECTIVE STUDY

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Urinary tract infections (UTIs) represent a significant public health challenge due to their high prevalence. This study aimed to provide the most up-to-date data on the incidence of Community-Aquired UTIs (CAUTIs) and susceptibility profile of Escherichia coli (E. coli) causing these infections in Tiaret Province, Western Algeria. A total of 835 urine cytobacteriological exams were analyzed, and the antibiotic sensitivity of 56 E. coli isolates was evaluated over a three-month period, from January 2 to March 30, 2024. The results indicated that out of the 835 urine samples analyzed, 77 were positive, representing a rate of 9%. Among these positive cases, 70.13% were women and 29.87% were men. The bacteriological profile showed a predominance of E. coli with 72.72% of the total cases, followed by Klebsiella spp. (12.98%), Pseudomonas sp. (7.79%), Staphylococcus aureus (2.59%), Proteus mirabilis (1.29%), Streptococcus spp. (1.29%), and Enterobacter sp. (1.29%). The antibiotic resistance evaluation of the E. coli isolates revealed the following resistance rates: ampicillin (75%), trimethoprim/sulfamethoxazole (44.64%), cefazolin (23.21%), amoxicillin/clavulanic acid (16.64%), cefotaxime (10.71%), cefoxitin (7.14%), gentamicin (7.17%), ertapenem (1.78%), amikacin (1.78%), and nitrofurantoin (0%). Understanding the incidence and resistance patterns of UTIs is crucial for guiding clinical practice, optimizing antimicrobial management, and implementing effective public health interventions for prevention and control

Keywords: *Antibiotic resistance, Bacteriological profile, Escherichia coli, Tiaret, Urinary tract infection*

INTRODUCTION

UTIs pose a considerable public health challenge due to their exceptionally high occurrence rate, with an estimated annual incidence exceeding 150 million cases worldwide[1]. Two varieties of UTIs are identified: hospital-associated urinary tract infection and CAUTIs [2]. Following respiratory infections, CAUTIs are the second most prevalent type of infection, affecting individuals across all genders, age groups, and demographics, with a particularly significant impact on women under 50 years old in developing countries[3]. These infections, originating outside of healthcare facilities, can manifest in various forms, ranging from uncomplicated cystitis to more severe pyelonephritis, posing significant health challenge globally[4].

UTIs are primarily caused by a range of uropathogens, especially bacteria such as *Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis and Staphylococcus saprophyticus*[5]. In general, *Escherichia coli* stands as the predominant uropathogen, accounting for approximately 80% of UTIs, followed by other prevalent pathogens including *Proteus* spp., *Staphylococcus saprophyticus*, *Klebsiella* spp.,

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and several other members of the *Enterobacteriaceae* family[2]. Prompt diagnosis and appropriate management of UTIs are essential to avoid complications such as recurring infections, renal damage, and systemic spread of infection[6]. While antimicrobial therapy continues to be fundamental for treatment, the rising levels of antimicrobial resistance among uropathogens pose significant challenges to effective management [7].

The 2022 report from the Global Antimicrobial Resistance and Use Surveillance System (GARUSS) underscores concerning levels of resistance among prevalent bacterial pathogens. Median rates reported across 76 countries reveal an alarming 42% resistance to third-generation cephalosporins in *E. coli* and 35% resistance to methicillin in *Staphylococcus aureus*[8]. Additionally, in 2020, one out of every five cases of UTIs caused by *E. coli* exhibited reduced susceptibility to standard antibiotics like ampicillin, co-trimoxazole, and fluoroquinolones. This situation is making the effective treatment of common infections increasingly challenging [9].

Algeria, like many other developing countries, is grappling with the burden of urinary tract infections, especially in the province of Tiaret, where factors such as lack of awareness, inadequate hygiene practices, socioeconomic status, and suboptimal healthcare services contribute to the increasing incidence of these infections. For that, the understanding of the incidence of UTIs and the determination of antimicrobial resistance pattern are essential for guiding clinical practice and public health interventions aimed at prevention and control. Therefore, the aim of this study is to provide the most up-to-date data on the incidence of CAUTIs and susceptibility profile of *E. coli* causing these infections in Tiaret Province, Western Algeria.

MATERIAL AND METHODS

Ethical approval

This research was performed following the department of nature and life sciences, faculty of nature and life sciences, university of Tiaret guidelines

Research area

The present investigation was conducted in the region of Tiaret, situated in Western Algeria with a subtropical climate.

Study design

A retrospective descriptive study was conducted at the private medical analysis laboratory Maachi, located in the province of Tiaret. This investigation included 835 cytobacteriological urine examinations (CBEU) carried out over a period of 3 months, from January 2, 2024, to March 30, 2024.

Data collection

Data were obtained from the bacteriology records of the Maachi Microbiological Analysis Laboratory, where various parameters were collected for each patient: name, surname, gender, age, date of sampling, origin of the sample, and CBEU results.

Sampling

A total of 835 urine samples were collected from outpatients of different age groups, suspected of harboring a UTI. Wide-mouthed sterile universal screw-capped bottles, labeled with patient information, were used to collect first morning clean-catch midstream urine samples, which were immediately subjected to microbiological analysis and assessment of antimicrobial drug susceptibility.

Urinalysis

The color and appearance of urine samples were examined macroscopically. However, the physical, chemical, and sedimentary properties of urine were analyzed by using commercially urinalysis test strips (AFCO, Jordanie), and a fully automated integrated urine analyzer UF-1500 (Sysmex Corporation, Germany), according to the guidelines provided by the manufacturer. The following parameters were analyzed: ascorbic acid, glucose, bilirubin, ketones, specific gravity, blood, pH, protein, urobilinogen, nitrates, leukocytes esterase, red blood cells, white blood cells, squamous epithelial cells, casts, crystals, bacteria, and yeast [10].

Microbiological analysis

The routine microbiological techniques were used for the identification of bacteria. 10

µL from each urine sample from outpatients suspected of having a UTI were inoculated by a calibrated wire loop onto CHROMagar™ Orientation (CHROMagar, France), and incubated during 18–20 h at 35 ± 2°C. Bacteria were identified based on the phenotypic characteristics observed on CHROMagar™ Orientation medium. The samples were considered positives if a single bacterium (pure culture) grew at a concentration of at least 10^5 CFU/ml [11].

Drug susceptibility testing

The susceptibility of *E. coli* isolates to antimicrobial agents was assessed by VITEK 2 AST-N 365 system (BioMerieux, France). The following antimicrobial agents were tested: ampicillin (AMP), amoxicillin/clavulanic acid (AMC), cefazoline (CZ), cefoxitine (FOX), cefotaxime (CTX), ertapenem (ETP), gentamicin (GN), amikacin (AN), nitrofurantoin (NIT) and trimethoprime/sulfamethoxazol (SXT). The susceptibility profiles were determined according to the Clinical Laboratory Standards Institute (CLSI, 2019)[12] breakpoints and results were reported as susceptible (S), intermediately resistant (I) or resistant (R).

Statistical Analysis

All data were analyzed using Excel 2016 software. The results were presented in the form of percentages.

RESULTS AND DISCUSSION

Results

According to the results reported in **Tables 1 and 2**, a total of 835 urine samples were analyzed using cytobacteriological examinations (CBEU) at the Maachi Microbiological Analysis Laboratory. Out of these, 758 samples (91%) were negative to the presence of bacteria, while 77 samples (9%) tested positive for bacterial infections. Furthermore, the CBEU results indicated a gender distribution among the 77 positive cases. Of these, 23 cases (29.87%) were male, while 54 cases (70.13%) were female.

The results of **Table 3** illustrate the incidence of various bacterial infections among different age groups. In the group aged 0-14, the most commonly observed bacteria among males, were *E. coli*, affecting 20% of cases, and *Klebsiella* spp., with an incidence of 40%. Meanwhile, among females, *E. coli* was more prevalent, affecting 87.5% of cases. *Pseudomonas* sp. was observed in 20% of male cases and 6.25% of female cases. The other bacteria such as *Staphylococcus aureus*, *Proteus mirabilis*, *Streptococcus* spp., and *Enterobacter* sp. were either absent or very rare among this age group.

Table 1: Global distribution of analysed urine samples.

Samples	Number	Frequency (%)
CBEU negative	758	91
CBEU positive	77	9
Total	835	100

Table 2: Distribution of positive urine cultures according to sex.

CBEU positive	Number	Frequency (%)
Male	23	29,87
Female	54	70,13
Total	77	100

Table 3: Distribution of isolated germs according to age and sex.

		Age 0-14		Age 15-34		Age 35-59		Age 60-85		Total	
		Male (n=05)	Female (n=16)	Male (n=02)	Female (n=12)	Male (n=04)	Female (n=18)	Male (n=12)	Female (n=08)	Male (n=23)	Female (n= 54)
E. coli	**n**	01	14	01	10	02	18	04	06	08	48
	%	20	87.5	50	83.33	50	100	33.33	75	34.78	88.88
***Klebsiella* spp.**	**n**	02	00	01	01	02	00	03	01	08	02
	%	40	00	50	8.33	50	00	25	12.5	34.78	3.70
***Pseudomonas* sp.**	**n**	01	01	00	00	00	00	03	01	04	02
	%	20	6.25	00	00	00	00	25	12.5	17.39	3.70
Staphylococcus aureus	**n**	00	00	00	00	00	00	02	00	02	00
	%	00	00	00	00	00	00	16.66	00	8.69	00
Proteus mirabilis	**n**	01	00	00	00	00	00	00	00	01	00
	%	20	00	00	00	00	00	00	00	4.34	00
***Streptocoque* spp.**	**n**	00	00	00	01	00	00	00	00	00	01
	%	00	00	00	8.33	00	00	00	00	00	1.85
***Enterobacter* sp.**	**n**	00	01	00	00	00	00	00	00	00	01
	%	00	6.25	00	00	00	00	00	00	00	1.85

In the age group of 15-34, among males, 50% of cases were attributed to *E. coli*, while *Klebsiella* spp. accounted for the remaining 50%. However, among females, *E. coli* was more prevalent, affecting 83.33% of cases, with *Klebsiella* spp. affecting only 8.33% of cases. The other bacterial strains such as *Pseudomonas* sp., *Staphylococcus* aureus, *Proteus mirabilis*, and *Enterobacter* sp. were absent in both genders within this age group. However, *Streptococcus* spp. was detected in 8.33% of female patients, while no occurrences were observed in males.

In the age group of 35-59, *E. coli* and *Klebsiella spp.* were both observed, among males, each accounting for 50% of cases. However, among females, *E. coli* infections were remarkably more prevalent, impacting 100% of cases, while *Klebsiella* spp. was absent. Additionally, the other bacterial strains such us *Pseudomonas* sp., *Staphylococcus aureus*, *Proteus mirabilis*, *Streptocococcus* spp., and *Enterobacter* sp. were not detected in either gender within this age group.

In the age group of 60-85, *E. coli* infections were observed, among males, in 33.33% of cases, while among females, the incidence was particularly higher at 75%. However, *Klebsiella* spp. and *Pseudomonas* sp. were both more prevalent among males, with 25% compared to 12.5% in females. *Staphylococcus aureus* infections were present in 16.66% of male cases, while females showed no instances of this bacterial strain. Finally, no cases of *Proteus mirabilis*, *Streptococcus spp*., or *Enterobacter* sp. were detected in either gender within this age group.

Regarding the entire population, *E. coli* infections were particularly more prevalent among females, comprising a significant 88.88% of the cases, while among males, the incidence was remarkably lower at 34.78%. In contrast, *Klebsiella* spp. infections demonstrated a higher incidence among males, accounting for 34.78% compared to only 3.70% among females. Similarly, *Pseudomonas* sp. infections were more frequently observed among males (17.39%) compared to females (3.70%). However, *Staphylococcus aureus* and *Proteus mirabilis* exhibited an incidence of

8.69% and 4.34% among males, respectively, whereas they were absent among females. Furthermore, *Streptococcus* spp. and *Enterobacter* sp. were identified in 1.85% of female patients each, contrasting with their absence in the male patients.

The results of **Table 4** reveal varying levels of antibiotic resistance among males and females. In the pediatric population, resistance was observed among males, in all cases to ampicillin, reflecting a 100% resistance rate. Meanwhile, among females, ampicillin resistance was prevalent but slightly lower, with 85.71% of cases exhibiting resistance. For amoxicillin/clavulanic acid, resistance was absent in males but present in 21.14% of female cases. Similarly, cefazoline resistance was absent in males but present in 28.57% of females. Others antibiotics, including cefoxitin, cefotaxime, ertapenem, amikacin, gentamicin, nitrofurantoin, and trimethoprim/sulfamethoxazole showed complete susceptibility in males. However, in females, resistance rates of 7.14% were observed to cefotaxime and ertapenem, while trimethoprim/sulfamethoxazole resistance exhibited a rate of 50%.

In the age group 15-34, ampicillin resistance was observed in all male cases, indicating a 100% resistance rate, while females exhibited a lower but still significant resistance rate of 50%. Similarly, for amoxicillin/clavulanic acid and cefazoline, resistance was absent in males but present in 20% of female cases. Resistance to cefoxitine and gentamicin was also observed in a minority of female cases, with rates of 10% each. Additionally, trimethoprim/sulfamethoxazole resistance was complete among males (100%) and present in 30% of females. However, none of the isolates exhibited any resistance in either gender within this age group to cefotaxime, ertapenem, amikacin, and nitrofurantoin.

In the age group 35-59, ampicillin resistance was observed in 50% of male cases, while females exhibited a significantly higher resistance rate of 77.77%. Similarly, for amoxicillin/clavulanic acid, cefazoline, cefoxitine, and cefotaxime, resistance was absent in males but present in varying percentages of female cases, ranging from 16.66% to 33.33%. Additionally, Trimethoprim/sulfamethoxazole resistance was higher among females, with a rate of 44.44%, while no resistance was observed among males. Resistance to gentamicin was observed in a minority of female cases, with a rate of 5.55%. while no resistance was noted to ertapenem, amikacin, and nitrofurantoin in either gender within this age group.

In the elderly population aged 60-85, the data reveal among males a high resistant rate of 75% to ampicillin, while among females, it was even higher at 83.33%. For amoxicillin/clavulanic acid, cefazoline, and cefotaxime, resistance was absent in males but present in a minority of female cases, ranging from 16.66% to 25%. Additionally, resistance to gentamicin and amykacin were observed in female cases, with a rate of 33.33% and 16.66%, respectively. A resistance rate of 25% to trimethoprim/sulfamethoxazole was observed among males, contrasting with a higher rate of 83.33% in females. However, none of the isolates exhibited any resistance to cefoxitin, ertapenem, or nitrofurantoin in either gender within this age group.

Regarding the the analysis of antibiotic resistance within the entire population, ampicillin resistance was observed in 75% of male and female cases, while resistance to amoxicillin/clavulanic acid was absent in males but present in 22.91% of females . Similarly, cefazoline resistance was absent in males but noted in 27.08% of female cases. Cefoxitin resistance was absent in males but observed in 8.33% of female cases. For cefotaxime, resistance rates were 12.5% among males and 10.41% among females. Ertapenem and amikacin resistance was minimal in both genders, with rates of 2.08% each among females. Gentamicin resistance was noted in 8.33% of female cases, while nitrofurantoin resistance was absent in both genders. Trimethoprim/sulfamethoxazole resistance was observed in 25% of male cases and particularly higher in females at 47.91%.

According to the results presented in **Table 5**, 25% of *E. coli* isolates were resistant to one class of antibiotic, while 37.5% showed resistance to two classes. Additionally, 16.07% of the isolates were identified as multidrug-resistant, with 10.71% resistant to three classes and 5.35% to four classes.

Table 4: Antibiotic resistance rates of isolated *E. coli* according to age and sex.

		Age 0-14		Age 15-34		Age 35-59		Age 60-85		All ages	
		Male (n=01)	Female (n=14)	Male (n=01)	Female (n=10)	Male (n=02)	Female (n=18)	Male (n=04)	Female (n=06)	Male (n=08)	Female (n=48)
Ampicillin	N	1	12	1	5	1	14	03	5	6	36
	%	100	85.71	100	50	50	77.77	75	83.33	75	75
Amoxicillin/ clavulanic acid	N	00	03	00	02	00	05	00	01	0	11
	%	00	21.14	00	20	00	27.77	00	16.66	00	22.91
Cefazoline	N	00	4	00	02	00	06	00	01	00	13
	%	00	28.57	00	20	00	33.33	00	16.66	00	27.08
Cefoxitine	N	00	0	00	01	00	03	00	00	00	04
	%	00	0	00	10	00	16.66	00	00	00	8.33
Cefotaxime	N	00	1	00	00	00	03	01	01	01	05
	%	00	7.14	00	00	00	16.66%	25	16.66	12.5	10.41
Ertapenem	N	00	1	00	00	00	00	00	00	00	01
	%	00	7.14	00	00	00	00	00	00	00	2.08
Amikacin	N	00	0	00	00	00	00	00	01	00	01
	%	00	0	00	00	00	00	00	16.66	00	2.08
Gentamicin	N	00	0	00	01	00	01	00	02	00	04
	%	00	0	00	10	00	5.55	00	33.33	00	8.33
Nitrofurantoin	N	00	0	00	00	00	00	00	00	00	00
	%	00	0	00	00	00	00	00	00	00	00
Triméthoprime/ sulfamethoxazol	N	00	7	01	03	00	08	01	05	02	23
	%	00	50	100	30	00	44.44	25	83.33	25	47.91

Table 5: Profiles of multidrug resistance among *E. coli* isolates.

Number of class of antibiotics	Number of *E. coli* isolates (n=56)	Percentage of resistance (%)
1	14	25
2	21	37.5
3	06	10.71
4	03	5.35
5	00	00
6	00	00
MDR	09	16.07

MDR: Multidrug Resistance, according to Magiorakos et al.[13].

Discussion

CAUTIs represent a significant public health concern due to their high prevalence, propensity to cause complications, and impact on affected individuals. These infections, typically caused by uropathogenic *E. coli* and other bacterial pathogens, place a substantial strain on healthcare systems worldwide [11,14]. The consequences of CAUTIs extend beyond the immediate discomfort and inconvenience experienced by patients, often leading to serious complications such as pyelonephritis, bacteremia, and sepsis, especially in vulnerable populations such as the elderly and individuals with compromised immune systems. Moreover, the emergence of antimicrobial resistance poses a growing threat, complicating treatment and increasing the risk of therapeutic failure and recurrences[5,15]. The present study aimed to provide the most up-to-date data on the incidence of CAUTIs and susceptibility profile of *E. coli* causing these infections in Tiaret Province, Western Algeria.

In the current study, The CBEU revealed that out of the 835 urine samples analyzed during the study period, 77 were positive, representing a rate of 9%. These results are partially in agreement with those reported by Al Mamari et al. [16] in Oman, who found that over a 10-year period, 650 cases (14.6%) showed positive CBEU results out of a total of 4437 patients across all age groups. In contrast to our results, other studies have reported higher incidences of UTIs. Corcoda et al.[17] reported in Denmark that out of the 485 patients examined, 261 (54%) had positive bacterial cultures. Additionally, Gebretensaie et al.[18] in Ethiopia found that out of 446 patients, 31% were infected.

The disparities in UTI incidence between countries can be attributed to several factors. These include the demographics of the population studied, such as age and gender. Certain age groups and females, in particular, are more susceptible to UTIs[19]. Additionally, differences in medical practices across countries play a significant role. Variances in hygiene protocols and healthcare systems, including antibiotic availability and infection prevention strategies, further contribute to these differences[20]. Therefore, a comprehensive understanding of these factors is crucial for developing prevention and treatment strategies appropriate to each local context.

Bacterial infections exhibit a higher incidence among women, comprising a significant majority of cases within the total population, while among men, the incidence is remarkably lower. The findings align with the study of Joya et al.[21], who investigated prevalent bacterial uropathogens among UTI patients at the French Medical Institute in Kabul, Afghanistan. They found that a significant majority of patients were female (69.6%), contrasting with the remaining 30.4% who were male. Alhazmi et al.[14] corroborated these findings, identifying a total of 1082 urinary bacterial samples. Their research highlighted a significant gender discrepancy, with females experiencing a higher incidence of bacterial infections (62.66%) compared to males (37.34%).

Regarding the uropathogens associated with CAUTIs in the current study, *E. coli* infections had a significantly higher incidence among females, accounting for 88.88% of cases, followed by *Klebsiella* spp. and *Pseudomonas* sp., each accounting for 3.7%. Conversely, among males, the prevalence is particularly lower, with *E. coli* and *Klebsiella* spp. at 34.78% each, followed by *Pseudomonas* sp. at 17.39%. However, *Staphylococcus aureus*, *Proteus mirabilis*, *Streptococcus* spp., and *Enterobacter* spp. show minimal or no occurrence among male and female patients. Several studies partially align with these findings, Sohail et al. [22] observed that *E. coli* was the most frequently encountered bacterium (62%) in urine samples testing positive in culture, followed by *Enterococcus faecalis* (15%), *Pseudomonas* (6%), *Klebsiella* spp. (1%), *Proteus* (1%), and *Staphylococcus aureus* (1%). Additionally, Joya et al.[21] found that among the 1780 patients examined, 341 cases (19.15%) tested positive for uropathogens. Among these cases, the most prevalent bacterial uropathogens were *E. coli* (63.9%), *Enterococcus* (11.1%), *Serratia* species (10.8%), *Staphylococcus* species (8.2%), *Klebsiella* (2.9%), *Proteus* species (1.8%), and *Pseudomonas aeruginosa* (1.2%).

The results of this study highlight significant disparities in the distribution of various bacterial species among male and female patients, as well as across the entire population with UTIs. Various risk factors may influence the occurrence of these infections. In women, anatomical features such as a shorter urethra and its proximity to the anus increase susceptibility to UTIs. Additionally, hormonal changes, such as fluctuations in estrogen levels during menstrual cycles and menopause, can alter vaginal pH and reduce protective flora, thereby facilitating bacterial colonization of the urinary tract. In contrast, in men, risk factors are often associated with underlying health conditions, such as an enlarged prostate obstructing urine flow, urinary retention, or structural abnormalities in the urinary tract. UTIs are also associated with conditions such as diabetes mellitus, which compromises immune function, increasing vulnerability to UTIs in both genders [23,24].

In the current study, the data on the antimicrobial susceptibility of *E. coli* provide valuable insights into the gender-specific patterns of antibiotic resistance among male and female patients. In terms of resistance to specific antibiotics, both male and female patients demonstrated a high level of resistance to ampicillin, with rates of 75% in both groups. This finding aligns with previous research indicating a high percentage of ampicillin resistance, exceeding 80% [25,1,26,21]. However, other authors have reported lower rates of resistance. Daoud et al.[27] assessed the antimicrobial susceptibility patterns of *E. coli* among Tunisien outpatients with CAUTIs over a seven-year period (2012-2018) and found that susceptibility rates to ampicillin ranged from 31.8% to 47%. In the current study, the resistance of *E. coli* to ampicillin can be attributed to its widespread use, particularly in the treatment of UTIs. Indeed, this pathogen may acquire resistance through various mechanisms, including the production of beta-lactamase enzymes, the acquisition of plasmid-mediated resistance genes, and alterations in penicillin-binding proteins or reduced permeability of the bacterial cell wall [28,29,30].

A significant gender variation was observed in terms of resistance to amoxicillin/clavulanic acid and cephalosporin antibiotics, including cefazolin, cefoxitin, and cefotaxime. Female patients exhibited higher resistance rates of 22.91%, 27.08%, 8.33%, and 10.41%, respectively, compared to males (0%), except for cefotaxime, where *E. coli* demonstrated a resistance rate of 12.5%. This report contradicts the findings of Okafor et al.[31] in Nigeria, who observed high resistance rates to Augmentin, with 100% of the tested *E. coli* isolates demonstrating resistance, including 42% among males and 58% among females. In India, Kulkarni et al.[32] reported a resistance rate of 71.90% against amoxicillin/clavulanic acid. Furthermore, among Tunisian outpatient, high resistance rates were observed over a period of seven years, ranging from 91.6% to 98.2% to cefotaxime. The low rate of resistance observed in this study can be explained by the rarity of certain types of *β*-lactamases in *E. coli*. AmpC-type *β*-lactamases are generally resistant to clavulanic acid and cephalosporins. They are chromosomally encoded and can be induced by antibiotic pressure, such as that exerted by amoxicillin. Although these enzymes are commonly expressed by species such as *Citrobacter* spp., *Serratia* spp., and *Enterobacter* spp., they are rarely observed in *E. coli*. Consequently, *E. coli* strains exhibit fewer resistance mechanisms against these classes of antibiotics[28].

The *E. coli* strains isolated in this study exhibited a resistance rate of 1.78% to ertapenem. Several studies have reported similar rates. Mouanga Ndzime et al.[33] recorded a resistance rate of 2% to this antibiotic. Additionally, Benaissa et al.[34] observed a resistance rate of 3% in Morocco. Regarding aminoglycosides, such as amikacin and gentamicin, the resultsof the current study revealed that only women showed resistance to these two antibiotics, with rates of 2.08% and 8.33%, respectively. However, Gu et al.[35] reported slightly higher resistance rates in China affecting both sexes, with 22.5% and 5.8% for men and women, respectively, against amikacin. For gentamicin, men had a resistance rate of 25% compared to 35.6% for women. This apparent preservation of the efficacy of aminoglycosides could be explained by their frequent parenteral administration, which limits their use[33].

The resistance to sulfonamide/ trimethoprim was observed at a higher rate of 44.64%, exceeding the 38.1% reported by Daoud et al.[27] in Tunisia. The resistance in the present study was higher in women, reaching 47.91% compared to 25% in men. Similar findings were partially reported by Alanazi et al.[2], who observed a resistance rate of 49.43% in women and 42.86% in men. These results suggest that *E. coli* resistance to sulfonamides/trimethoprim may be attributed to the bacterium's ability to transfer resistance genes via mobile genetic elements, coupled with selective pressure induced by the frequent use of this antibiotic, thereby promoting the spread of this resistance[36].

Finally, no resistance to nitrofurantoin was observed in in either sex during this study. Several studies have reported low resistance rates to this antibiotic. A study conducted by Tano et al.[11] revealed that the resistance rate of uropathogenic *E. coli* strains to nitrofurantoin was relatively low, at 3.6% in Brazil. In Tunisia, Daoud et al. [27] reported sensitivity rates ranging from 94% to 100%. These low resistance rates may be due to nitrofurantoin's unique mode of action, which involves multiple mechanisms and requires simultaneous mutations for resistance to develop [36]. However, a study conducted in Honduras by

Zúniga-Moya et al.[37], reported a higher resistance rate of 32.8%, highlighting the need for continuous monitoring. The prudent use of nitrofurantoin remains essential to preserve its efficacy against urinary tract infections caused by uropathogenic *E. coli*.

Conclusion

This study demonstrated a high incidence of community-acquired urinary tract infections in women compared to men, with a predominance of *E. coli* bacteria, followed by *Klebsiella* spp., *Pseudomonas* sp., *Staphylococcus aureus*, *Streptococcus* spp., *Enterobacter* sp., and *Proteus mirabilis*. *E. coli* demonstrated high levels of resistance to ampicillin, trimethoprim/sulfamethoxazole, amoxicillin/clavulanic acid, and cefazolin, while cefoxitin, cefotaxime, ertapenem, gentamicin, amikacin, and nitrofurantoin remain the most effective antibiotics against uropathogenic strains of *E. coli*.

These results highlight the importance of continuous monitoring of antibiotic resistance profiles, particularly for common urinary pathogens like *E. coli*. The variations in resistance based on sex and age also suggest the need for personalized therapeutic approaches. Furthermore, the presence of multi-resistant bacteria emphasizes the urgent need for new treatment strategies and preventive measures to control the spread of these resistant strains.

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معدل حدوث ونمط الحساسية لمضادات الميكروبات للإشريكية القولونية المسببة لعدوى المسالك البولية المكتسبة من المجتمع في ولاية تيارت، غرب الجزائر: دراسة بأثر رجعي

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تمثل التهابات المسالك البولية تحديًا كبيرًا للصحة العامة بسبب ارتفاع معدل انتشارها. هدفت هذه الدراسة إلى توفير أحدث البيانات حول معدل حدوث التهابات المسالك البولية المكتسبة من المجتمع وخصائص الحساسية للإشريكية القولونية . المسببة لهذه الالتهابات في ولاية تيارت، غرب الجزائر. تم تحليل ما مجموعه ٨٣٥ فحصًا خلويًا للبول، وتم تقييم حساسية المضادات الحيوية لـ ٥٦ من عزلات الإشريكية القولونية على مدى ثلاثة أشهر، من ٢ يناير إلى ٣٠ مارس ٢٠٢٤. أشارت النتائج إلى أنه من بين ٨٣٥ عينة بول تم تحليلها، كانت ٧٧ عينة إيجابية، وهو ما يمثل نسبة ٩%. من بين هذه الحالات الإيجابية، كانت ٧٠.١٣% من النساء و٢٩.٨٧% من الرجال. أظهر البروفيل البكتريولوجي غلبة بكتيريا الإشريكية القولونية بنسبة ٧٢.٧٢% من إجمالي الحالات، تليها بكتيريا الكلبسيلا (١٢.٩٨%) وبكتيريا الزائفة (٧.٧٩%) والمكورات العنقودية الذهبية (٢.٥٩%) والمكورات العنقودية الذهبية (٢.٥٩%) والبروتيوس ميرابيليس (١.٢٩%) والمكورات العقدية (١.٢٩%) وبكتيريا المعوية (١.٢٩%). كشف تقييم مقاومة المضادات الحيوية لعزلات الإشريكية القولونية عن معدلات المقاومة التالية: الأمبيسيلين (٧٥%)، تريميثوبريم/سلفاميثوكسازول (٤٤.٦٤%)، سيفازولين (٢٣. ٢١%) وأموكسيسيلين/حمض الكلافولانيك (١٦.٦٤%) وسيفوتاكسيم (١٠.٧١%) وسيفوكسيتين (٧.١٤%) وجنتاميسين (٧.١٧%) وإيرتابينيم (١.٧٨%) وأميكاسين (١.٧٨%) ونيتروفورانتوين (٠%). إن فهم أنماط الإصابة بالتهابات المسالك البولية ومقاومتها أمر بالغ الأهمية لتوجيه الممارسة السريرية، وتحسين إدارة مضادات الميكروبات، وتنفيذ تدخلات فعالة في مجال الصحة العامة للوقاية والسيطرة.