

Study of Antibiotic-resistant Bacteria Isolated from Children with Urinary Tract Infection

Abbas H. S. Al-Wandawy*¹, Luma A. Zwain², Murad R. Wali³

¹Directorate of Education of Kirkuk, Ministry of Education, Kirkuk, Iraq

²Department of Biology, Collage of Education Pure Science Ibn Al-Haitham, University of Baghdad, Iraq

³Ministry of Health, Kirkuk health directorate, Kirkuk, Iraq

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ABSTRACT

Urine samples 96 to 100 were collected from patients (children) with urinary tract infections (UTIs) from Azadi Hospital in Kirkuk province, Iraq, where included (76 males and 120 females) with ages ranging from (\geq one-15) years old, for period from 1/1/2022 to 26/4/2022. The study included isolation and identification depending on macroscopic, microscopic and definite with API 20e and API *Staphylococcus*. Moreover, all isolates were tested for resistance to 23 antibiotics. 55 bacterial isolations were obtained and *E. coli* had the highest rate of 27 (49.09%) followed by *Klebsiella* spp. with 14 (25.45%) and each of the bacteria, *Staphylococcus aureus*, *Proteus* spp., *Citrobacter* spp., *Enterobacter* spp., *Pseudomonas* spp. and *Morganella morganii* they reached 4(7.27%), 5(9.09%), 1(1.81%), 2 (3.63%), 1(1.81%) and 1(1.81%), respectively.

Result showed enterobacteriaceae higher resistance to amoxicillin-clavulanate (100%). *E. coli* had the highest rate and were resistance 100% to tobramycin, penicillin and amoxicillin, followed by amoxicillin-clavulanate and ampicillin (96.29 and 91.66), respectively. At the same time (Doxycycline, Cefotaxime, Tetracycline, Cefepime, Trimethoprim, Cefotaxime) were (88.88, 88, 85.71, 84, 83.33, 81.81%), respectively. At the same time, *Pseudomonas* spp. were resistant to (Ampicillin, Cefotaxime, *Morganella morgani*, and Erythromycin) 100% and *S. aureus* were resistant to (Amoxicillin-clavulanate, Cefotaxime, Cefepime, Erythromycin, Norfloxacin, Tetracycline, Cefotaxime, *Morganella morgani*, Amikacin) 100%.

Keywords: Antibiotic-resistant bacteria, Children, Urinary tract infection.

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INTRODUCTION

Urinary tract infection (UTI) is one of the most common diseases due to bacteria, and infection can occur worldwide in childhood and have serious consequences, especially for young children.¹ It is also one of the most acquired bacterial infections in humans, and most cases occur as severe, uncomplicated injuries in healthy individuals.² Microbiome bacteria in the urinary tract play an important role in maintaining health by affecting bladder balance.³ Rapid diagnosis and appropriate treatment are very important to reduce the incidence of diseases associated with this condition, and symptoms and signs are not specified throughout the period of lactation, as unexplained fever is the most common symptom of UTI during the first two years of life the child, but inflammation of the kidney pelvis occurs after the second year of life and is characterized by fever, chills and pain in the flank. Symptoms and signs of the lower tract are suprapubic pain, dysuria, urinary frequency, cloudy and malodorous urine, and urine

culture and examination should be performed when UTI is suspected.⁴ Bacteria (*Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Staphylococcus epidermidis*, *Enterobacter aerogenes* and *Citrobacter freundii*) are a species of bacteria causing UTIs in children.⁵ *E. coli* bacteria make up 80–90% of urinary tract injuries in children.⁴ *E. coli*, *P. aeruginosa* and *Proteus* spp. were the most common species of UTI.⁶ *E. coli* bacteria are negative for a gram stain in the form of short rods, facultative anaerobe, fermentation of glucose and a wide range of carbohydrates, colon bacteria are considered part of the normal flora in the colon of human and other animals, but can be pathogenic inside and outside the digestive tract, causes many diseases for humans, including UTIs and diarrhea, as well as meningitis in infants.^{7, 8}

Pseudomonas bacteria are negative for a gram stain with moving rods and have a polar flagellum with a gene capsule and are aerobic or facultative, producing spreadable green and blue pigments.⁸⁻¹⁰ It is widespread in nature (soil,

*Author for Correspondence: abbas.wandawy@uokirkuk.edu.iq

water, plants and animals). These bacteria may colonize healthy individuals without causing the disease but are also an important opportunistic pathogen and a major cause of nosocomial infections, causing UTIs, inflammation of wounds and burns. *Enterobacter* species are negative for gram stains and are mobile and rarely occur in humans, but they occur in patients in the hospital,⁷⁻¹⁰ these bacteria cause burns, wounds, Pneumonia and UTI. *Proteus* spp. and *Morganella* are the causes of UTIs and other infections outside the intestines. Species of *Proteus* bacteria usually cause UTI acquired from the nosocomial UTI. Other extra-intestinal injuries such as wounds, lung inflammation and bacteremia are more frequent in patients with inhibitory immunity.^{7,9,10}

Klebsiella bacteria are large non-mobile rods with a capsule, which cause many diseases, including UTI, bacteremia and pneumonia.⁸⁻¹⁰ *Citrobacter* bacteria are mostly environmental pollutants isolated from water, soil, food, human feces and animals. Negative for gram stains, a mobile, lactose fermentation such as *E. coli* bacteria, but different from the latter by present positive citrate and lysine decarboxylase negative tests.^{8,10}

S. aureus bacteria are positive for gram stains, spherical clusters, facultative anaerobic, are found on the surfaces of the body and mucous membranes and cause many diseases, including wound and burns inflammation, bacteremia and UTI.⁷⁻¹⁰

Table 1: Number and percentages of patient (children) with UTI according to the gender.

Gender	Number	(%)Percentage
Male	76	38.77
Female	120	61.22

Table 2: Number and percentages of patient (children) with UTI according to the age

Age (year)	Number	(%)Percentage
≤year	67	34.18
1-5	62	31.63
6-10	47	23.97
11-15	11	5.61

Table 3: Number of positive samples divided by age category and gender

Total number of positive samples in bacterial culture	Age category (year)	Male number (%)	Female number (%)
55	Less than year	(58.62)17	(41.37)12
	1-5	(29.41)5	(70.85)12
	6-10	(0)0	(100)8
	11-15	(0)0	(0)1

MATERIALS AND METHODS

Collecting Samples

Urine samples 100 and 96 from male and female patients with ages ranging from (≥ one -15) years old .from the Children’s Hospital in Kirkuk, Iraq, from 1 January to 26 April, 2022.

Sample Culture

The samples were cultured on blood agar, mannitol agar and MacConkey agar and incubated at 37°C for 24 hours. All isolates of bacteria identification depending on macroscopic, microscopic and definite with API 20e and API Staph

Antibiotic Susceptibility Test

Kirby –Bauer disc diffusion method was used, and inhibition zones were dignified by a ruler and compared with clinical laboratories’ standard institution

RESULTS AND DISCUSSION

The results shown in Table 1, show the number of samples was 196, divided into 76 males with 38.77%, 120 females with 61.22%.

The results shown in Table 2, which shows age ranging from one month to 15 years , the age (the lowest year) reached 67 (34.18%) and the age from (1–5) years was 62 (31.63%) and (6–10) years of age reached 47 (23.97%), while the age (11–15) years was 11 (5.61%).

Samples 55 were positive for bacterial culture, and by (28.06%) (Figure 1) and included the age (less than one year), with 12 females (41.37%) and males 17 (58.62%) and the age (1--5) year, the females was 12 (70.85%) and males 5 (29.41%), the age (6–10) year and (11–15) year the number of females with UTI was 8 (100%) and 1 (100%) as shown in Table 3.

Indicated that the percentage of samples positive for male and female culture was 8.9, 10.7%, respectively, while negative samples of male and female bacterial culture were 91.1% for both gender. The previous study pointed to samples were positive for bacterial culture for the (1–5) year, which was 10% and negative was 80%, while the age from (6–15) year was 16% and negative bacterial culture was 82%.¹¹

The results note that the age (less than year- 5) year had the highest incidence of UTI and females more than males, which may be due to the physiological nature of the urinary system compared to the male urinary system, the high prevalence of UTI in females is unequivocally due to anatomical factors such

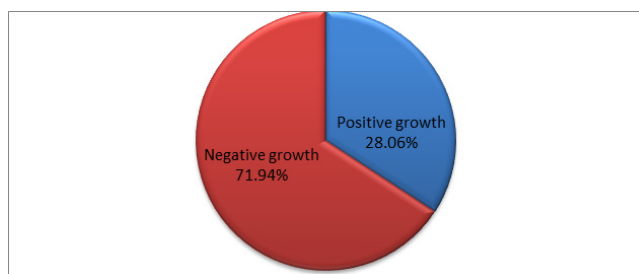


Figure 1: Percentage of positive and negative samples for bacterial culture.

as short urology and near the vagina opening from the anus that shortens the distance that bacteria must travel to reach the bladder and poor personal hygiene.¹¹

Table 4 shows the number and percentages of genera isolated from positive samples, with the results of the current study showing that *E. coli* was the highest at 27 (49.09%), followed by *K. spp.*, with 14 (25.45%) then each of *S. aureus*, *Proteus spp.*, *Citrobacter spp.*, *Enterobacter spp.*, *Pseudomonas spp.*

Table 4: Number and percentages of genera isolated from urine samples for children with UTI.

Bacterial genera	Number	Percentage
<i>E.coli</i>	27	49.09
<i>Klebsiella spp.</i>	14	25.45
<i>Staph.aureus</i>	4	7.27
<i>Proteus spp.</i>	5	9.09
<i>Citrobacter spp.</i>	1	1.81
<i>Enterobacter spp.</i>	2	3.63
<i>Pseudomonas spp.</i>	1	1.81
<i>Morganella morganii</i>	1	1.81
Total number	55	

and *Morganella morganii*) they were 4 (7.27%), 5 (9.09%), 1 (1.81%), 2 (3.63%), 1 (1.81%) and 1 (1.81%), respectively.

Lu⁵ referred to the percentage of *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. epidermidis*, *E. aerogenes*, *C. freundii*) causing UTI in children were (40.5, 8.9, 4.3, 2.0, 0.9, 0.5%), respectively. ⁶noted that *E. coli*, *P. aeruginosa* and *Proteus* were more likely to cause UTI and were formed (19.1, 14.3, 11.9%), respectively. ⁶indicated the percentage of *E. coli*, *P. aeruginosa*, *Proteus spp.*, *S. aureus*, *Citrobacter spp.*, *Enterobacter spp.*, *K. spp.*, *Enterococcus spp.* were (19.1, 14.3, 11.9, 11.9, 9.5, 9.5, 4.8, 4.8)% respectively.¹² Noted in his study that the prevalence of bacteria isolated from urine was *E. coli*, Coagulase negative *Staphylococcus* (CoNS), *S. aureus*, *K. pneumoniae*, *P. aeruginosa*, *Proteus mirabilis*, *Citrobacter spp.* and *M. morganii* at a percentage 43.5, 16, 16, 8.7, 7.2, 5.8, 4.4, 1.5%, respectively¹³ noted the prevalence of *K. pneumoniae* from urine.

Table 5 shows resistance to antibiotics by *E. coli*, were resistance 100% to tobramycin, penicillin and amoxicillin, followed by amoxicillin-clavulanate and ampicillin (96.29 and 91.66), respectively, while (doxycycline, ceftazidime, tetracycline, cefepime, trimethoprim, cefotaxime) were (88.88, 88, 85.71, 84, 83.33, 81.81%, respectively and trimethoprim was 78.57%.

Table 5: Resistance of *E. coli* to antibiotics

Antibiotic	<i>E. coli</i>						
	Number of isolates	Number of resistance isolates	%	Number of sensitive isolates	%	Mean of sensitivity	%
AM	12	11	91.66	1	8.33		
CTX	11	9	81.81	2	18.18		
Atm	14	11	78.57	3	21.42		
FEP	25	21	84	4	16		
AMC	27	26	96.29	1	3.70		
CAZ	25	22	88	3	12		
SXT	17	8	47.05	7	41.17	2	11.76
MEM	14	2	14.28	12	85.71		
AX	6	6	100				
AZM	7	4	57.14	3	42.85		
LEV	17	8	44.44	9	52.94		
CN	6	4	66.66	2	33.33		
IPM	10	1	10	8	80	1	10
NA	10	6	60	2	20	2	20
TE	14	12	85.71	1	7.14	1	7.14
DO	9	8	88.88	1	11.11		
TMP	6	5	83.33	1	16.66		
F	8	3	37.5	5	62.5		
AK	19	13	68.42	5	26.31	1	5.26
CIP	6	2	33.33	4	66.66		
TOB	1	1	100				
P	2	2	100				

AM/Ampicillin ,CTX/Cefotaxime, Atm/trimethoprim, FEP/cefepime, AMC/amoxicillin-clavulanate, CAZ/ceftazidime, SXT/cefotaxime, MEM/meropenem, AX/amoicillin, AZM/ azithromycin, LEV/levofloxacin, CN/cefotetan, IPM/imipenem, NA/nalidixic acid, TE/tetracycline, DO/doxycycline, TMP/trimethoprim, F/norfloxacin, AK/amikacin, CIP/ciprofloxacin, TOB/tobramycin, P/penicillin.

Amikacin, cefotetan, nalidixic acid were 68.42, 66.66, 60%, respectively. While (azithromycin, cefotaxime, levofloxacin, norfloxacin, ciprofloxacin, imipenem) were 57.14, 47.05, 44.44, 37.5, 33.33, 10%, respectively.

Table 6 shows resistance to *Klebsiella* spp. largely all antibiotics (ampicillin, amoxicillin-clavulanate, meropenem, amoxicillin, azithromycin, nalidixic acid, tetracycline, trimethoprim, ciprofloxacin, ceftriaxone) were 100%. It was 83.33% resistant to cefotaxime, while it was resistant to cefepime, cefotaxime, doxycycline, amikacin, ceftazidime by percentage 78.57, 75, 77.77, 72.72, 72% and trimethoprim and norfloxacin were resistant by percentage 62.5 and 60% and were 30% less resistant to levofloxacin.

Table 7 shows resistance to *Proteus* spp. for (ampicillin, cefotaxime, trimethoprim, amoxicillin-clavulanate, ceftazidime, cefotaxime, amoxicillin, azithromycin, cefotetan, nalidixic acid, tetracycline, doxycycline, trimethoprim, norfloxacin, amikacin, tobramycin) at percentage 100%. It was resistant to cefepime, levofloxacin, and meropenem by percentage (80, 50 and 33.33)%, respectively.

Table 8 shows *S. aureus* resistance to amoxicillin-clavulanate, cefotetan, cefepime, erythromycin, norfloxacin,

tetracycline, cefotaxime, amoxicillin, amikacin by percentage 100%, while clindamycin, meropenem were 50% resistant, and azithromycin at 66.66%, and (oxacillin and methicilin) were resistant by 33.33%.

Table 9 shows *Citrobacter* sp resistance to ampicillin, cefotaxime, ceftazidime, trimethoprim, cefepime, amoxicillin-clavulanate, ceftazidime, cefotaxime, levofloxacin, nalidixic acid, norfloxacin, amikacin by percentage 100%.

Table 10 shows *Enterobacter* spp resistance to ampicillin, cefotaxime, ceftazidime, trimethoprim, cefepime, amoxicillin-clavulanate, ceftazidime, cefotaxime, azithromycin, nalidixic acid, aoxycycline, amikacin by percentage 100%.

Table 11 refers to *Pseudomonas* spp resistance to ampicillin, cefotaxime, amoxicillin, erythromycin by a percentage 100%.

Table 12 shows *Morganella morganii* resistance to ampicillin, amoxicillin-clavulanate, cefepime, levofloxacin, nalidixic acid, nalidixic acid by percentage 100%.

E. coli have shown resistance to ciprofloxacin, amoxicillin, trimethoprim-sulfamethoxazole by percentage 75, 62.5, 62.5%, respectively *S. aureus* showed resistance to the antibiotics amoxicillin and erythromycin by percentage 80%.⁵

Table 6: Resistance of *Klebsiella* spp. to antibiotics

Antibiotic	<i>Klebsiella</i> spp.				Number of sensitive isolates	%	Mean of sensitivity	%
	Number of isolates	Number of resistance isolates	%					
AM	4	4	100					
CTX	6	5	83.33	1		16.66		
Atm/	8	5	62.5	3		37.5		
FEP	14	11	78.57	3		21.42		
AMC	13	13	100					
CAZ/	11	8	72.72	3		27.27		
SXT/	8	6	75	2		25		
MEM	4	4	100					
AX	1	1	100					
AZM	3	3	100					
LEV	10	3	30	7		70		
CN	1	1	100					
IPM	9			8		88.88	11.11	
NA	1	1	100					
TE	4	4	100					
DO	9	7	77.77	2		22.22		
TMP	2	2	100					
F	10	6	60	4		40		
AK	11	8	72.72	1		9.09	18.18	
CIP	1	1	100					
CRO	1	1	100					

AM/ampicillin, CTX/cefotaxime, Atm/trimethoprim, FEP/cefepime, AMC/amoxicillin-clavulanate, CAZ/ceftazidime, SXT/cefotaxime, MEM/meropenem, AX/amoicillin, AZM/azithromycin, LEV/levofloxacin, CN/cefotetan, IPM/imipenem, NA/nalidixic acid, TE/tetracycline, DO/doxycycline, TMP/trimethoprim, F/norfloxacin, AK/amikacin, CIP/ciprofloxacin, CRO/ceftriaxone, F/norfloxacin.

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Table 7: Resistance of *Proteus spp.* to antibiotics

Antibiotic	<i>Proteus spp.</i>						
	Number of isolates	Number of resistance isolates	%	Number of sensitive isolates	%	Mean of sensitivity	%
AM/	4	4	100				
CTX	1	1	100				
Atm	1	1	100				
FEP	5	4	80	1	20		
AMC	4	4	100				
CAZ	4	4	100				
SXT	2	2	100				
MEM	3	1	33.33	2	66.66		
AX	1	1	100				
AZM	1	1	100				
LEV	4	2	50	2	50		
CN	1	1	100				
IPM	1			1	100		
NA	2	2	100				
TE	1	1	100				
DO	3	3	100				
TMP	2	2	100				
F	4	4	100				
AK	4	4	100				
CIP	2			2	100		
TOB	1	1	100				

AM/ampicillin, CTX/cefotaxime, Atm/trimethoprim, FEP/cefepime, AMC/amoxicillin-clavulanate, CAZ/ceftazidime, SXT/cefotaxime, MEM/meropenem, AX/amoicillin, AZM/azithromycin, LEV/levofloxacin, CN/cefotetan, IPM/imipenem, NA/nalidixic acid, TE/tetracycline, DO/doxycycline, TMP/trimethoprim, F/norfloxacin, AK/amikacin, CIP/ciprofloxacin, TOB/tobramycin,

Table 8: Resistance of *S. aureus* to antibiotics.

Antibiotic	<i>S. aureus</i>						
	Number of isolates	Number of resistance isolates	%	Number of sensitive isolates	%	Mean of sensitivity	%
DA/	4	2	50	2	50		
AMC	3	3	100				
ME	3	1	33.33	1	33.33	1	
OX	3	1	33.33	2	66.66		
CN	2	2	100				
AZM	3	2	66.66	1	33.33		
FEP	2	2	100				
IPM	1			1	100		
E/	1	1	100				
MEM	2	1	50	1	50		
NX/	1	1	100				
TE	1	1	100				
SXT	1	1	100				
AX	1	1	100				
AK	1	1	100				

DA/clindamycin, AMC/amoxicillin-clavulanate, ME/methicillin, OX/oxacillin, CN/cefotetan, AZM/azithromycin, FEP/cefepime, IPM/imipenem, E/erythromycin, MEM/meropenem, NX/norfloxacin, TE/tetracycline, SXT/cefotaxime, AX/amoicillin, AK/amikacin.

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Table 9: Resistant of *Citrobacter spp.* to antibiotics

Antibiotic	<i>Citrobacter spp.</i>						
	Number of isolates	Number of resistance isolates	%	Number of sensitive isolates	%	Mean of sensitivity	%
AM	1	1	100				
CTX	1	1	100				
Atm	1	1	100				
FEP	1	1	100				
AMC	1	1	100				
CAZ	1	1	100				
SXT	1	1	100				
LEV	1	1	100				
IPM	1			1	100		
NA	1	1	100%				
F	1	1	100				
AK	1	1	100				

AM/ampicillin, CTX/cefotaxime, Atm/trimethoprim, FEP/cefepime, AMC/amoxicillin-clavulanate, CAZ/ceftazidime, SXT/cefotaxime, LEV/levofloxacin, IPM/imipenem, NA/nalidixic acid, F/norfloxacina, AK/amikacin.

Table 10: Resistance of *Enterobacter spp.* to antibiotics

Antibiotic	<i>Enterobacter spp.</i>						
	%	Mean of sensitivity	%	Number of sensitive isolates	%	Number of resistance isolates	Number of isolates
AM	1	1	100				
CTX	1	1	100				
Atm	1	1	100				
FEP	2	2	100				
AMC	2	2	100				
CAZ	2	2	100				
SXT	1			1	100		
MEM	2			2	100		
AZM	1	1	100				
LEV	2			2	100		
IPM	1			1	100		
NA	1	1	100				
DO	2	2	100				
F	1					1	100
AK	1	1	100				

AM/ampicillin, CTX/cefotaxime, Atm/trimethoprim, FEP/cefepime, AMC/amoxicillin-clavulanate, CAZ/ceftazidime, SXT/cefotaxime, MEM/meropenem, AZM/azithromycin, LEV/levofloxacin, IPM/imipenem, NA/nalidixic acid, DO/doxycycline, F/norfloxacina, AK/amikacin.

Resistance of *S. aureus* to the antibiotic tetracycline and clidamycin by (50.80%).¹⁴ Resistance to bacteria *E. coli* for antibiotics (ampicillin, amoxicillin-clavulanic acid, piperacillin/tazobactam, ceftriaxone, ceftazidime, imipenem, nalidixic acid, ciprofoxacin, ofoxacin, gentamicin, nitrofurantoin, SXT) and by percentage (77.7, 19.3, 3.8, 41.9, 22.0, 10.5, 0.6, 38.5, 16.2, 16.3, 18.7, 12.4, 77.2%), respectively.¹⁵

Resistance to *Klebsiella pneumoniae* bacteria isolated from urine for antibiotics (ampicillin, amoxicillin-clavulanic acid, piperacillin/tazobactam, ceftriaxone, ceftazidime, imipenem, nalidixic acid, ciprofoxacin, ofoxacin, gentamicin, nitrofurantoin, SXT) and by ratios (84.9, 12.7, 0, 41.4, 31.4, 14.3, 0.8, 21.7, 14.9, 10.1, 25.3, 23.2, 60.8%), respectively.^{15,16}

Resistance to *P. mirabilis* for both antibiotics (ampicillin, amoxicillin-clavulanic acid Piperacillin/Tazobactam, ceftriaxone, ceftazidime, imipenem, nalidixic acid, ciprofoxacin, ofoxacin, gentamicin, nitrofurantoin, SXT) and by percentage (50.3, 14.3, 0, 9.5, 8.3, 25, 4.5, 13.2, 5.6, 20.9, 71.3, 6.6, 58.5%), respectively.¹⁵

P. aeruginosa bacteria isolated from urine are resistant to both antibiotics (Ampicillin, Tetracycline, SXT) by percentage (80, 57.1, 57.1%), respectively. Gram-negative rods was resistant to ampicillin (96%), tetracycline (71.4%) and gram-positive spherical were also resistant to ampicillin (90%), tetracycline (55%).¹²

Table 11: Resistance of *Pseudomonas* spp. to antibiotics

Antibiotic	<i>Pseudomonas</i> spp.						
	%	Mean of sensitivity	%	Number of sensitive isolates	%	Number of resistance isolates	Number of isolates
AM	1	1	100				
FEP	1			1	100		
CAZ	1					1	100
SXT	1	1	100				
MEM	1			1	100		
AX	1	1	100				
AZM	1					1	100
LEV	1			1	100		
F	1					1	100
CIP	1			1	100		
E	1	1	100				

AM/ampicillin, FEP/cefepime, CAZ/ceftazidime, SXT/cefotaxime, MEM/meropenem, AX/amoxicillin, AZM/azithromycin, LEV/levofloxacin, F/norfloxacin, CIP/ciprofloxacin, E/erythromycin.

Table 12: Resistance of *Morganella morganii* to antibiotics.

Antibiotic	<i>Morganella morganii</i>							
	Number of isolates	Number of resistance isolates	%	Number of sensitive isolates	%	Mean of sensitivity	%	
AM	1	1	100					
FEP	1			1	100			
AMC	1	1	100					
CAZ	1	1	100			1	/	
SXT	1			1	100			
MEM	1			1	100			
AZM						1	100	
LEV	1	1	100					
NA	1	1	100					
DO	1	1	100					
AK	1					1	100	
CIP	1			1	100			

AM/Ampicillin, FEP/ Cefepime, AMC/Amoxicillin-clavulanate, CAZ/ Cefotaxime, SXT/ Cefotaxime, MEM/ Meropenem, AZM/ Azithromycin, LEV/Levofloxacin, NA/ Nalidixic acid, DO/ Doxycycline, AK/ Amikacin, CIP/Ciprofloxacin.

The resistance of ampicillin, sulfonamide trimethoprim-sulfamethoxazole - and ciprofloxacin resistance was closely linked to the presence of *bla_{SHV}*, *sul1*, *dfrA1* and *qnrA*, respectively.¹⁷

Tetracycline flow genes such as *tet* (A) and *tetB* were the most common resistance genes.¹⁷ The current study showed that bacteria' resistance to penicillin antibiotics is due to their production of β -lactamase enzymes, thereby destroying the effectiveness of the antibiotic, but its resistance to aminoglycoside is due to the possession of enzymes carried on mobile genetic elements that prevent the antibiotics from targeting bacterial ribosomes.¹⁸ Its resistance to fluoroquinolones is due to a genetic change of the topoisomerase enzyme and increased efflux pump expression.¹⁸⁻²⁰ While bacteria resistance to macrolides is due to a mutation in the site of ribosomes 23SrRNA or ribosomes protein.²¹ The resistance

of bacteria to the tetracyclines group is the result of a change in the location of ribosomes or the production of enzymes to inhibit the effectiveness of tetracycline inactivation enzyme.²² bacteria resistance to trimethoprim/sulphonamides is due to the genetic change of dihydropteroate synthase (DHPS).^{18,23}

CONCLUSION

From this study, we conclude that females under the age of 5 have urinary tract infections as well as the presence of *E. coli* bacteria in a large percentage. Most species of *Klebsiella* spp. bacteria were resistant to β -lactam antibiotics.

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