Razi Med J. 2026;2(1):35-45
https://doi.org/10.69667/rmj.26106
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Original article

Prevalence and Risk Factors of Urinary Tract Infection among Pregnant Women Attending Antenatal Clinics at Some Private Sectors in El Jabal Al Akhdar, Al-Byda, Libya

Najwa Belhamad[1], Boshra Fathalla[2], Marfoua Ali[3*]

[1]*Department of Microbiology, College of Medicine, Omar Al-Mukhtar University, AL Bayda, Libya*
[2]*Department of Obstetrics and Gynecology, College of Medicine, Omar Al-Mukhtar University, AL Bayda, Libya*
[3]*Department of Zoology, College of Science, Omar Al-Mukhtar University, AL Bayda, Libya*
Corresponding email. *marfouas@yahoo.com*

Abstract
Urinary tract infections (UTIs) are the most common bacterial infection, affecting about 8% of pregnant women. Untreated, they risk fetal preterm birth, low birth weight, death, preeclampsia, maternal anemia, and renal failure. To define the occurrence and risk factors of urinary tract infection during pregnancy and the microorganism associated with it. Cross-sectional research has been performed on 100 females at private clinics in Libya from January 2025 to September 2025. Urine cultures have been carried out for pregnant women. UTI prevalence was 80%, predominantly Escherichia coli (46.3%), followed by Staphylococcus (20%) and Streptococcus (18.8%) spp. Infected women were older (median 29 years, P=0.034), more symptomatic (76.3%, P<0.001), and had higher pus cell counts (P=0.041). No significant associations existed with residence, education, gestational age, trimester, gravidity, parity, or occupation. Multivariate logistic regression identified symptoms as the sole independent predictor (AOR equal to 5.31, ninety-five percent CI: 1.59–17.77, P-value equal to 0.007). Isolates showed high sensitivity to ciprofloxacin (77.5%) and ceftriaxone (65%), but resistance to amoxicillin (46.3%) and ampicillin (38.8%). In conclusion, High UTI prevalence (80%, predominantly E. coli) among pregnant women at Libyan private antenatal clinics. Infected women were older, more symptomatic, and showed higher pus cell counts. There were no significant associations with residence, education, gestational age, trimester, gravidity, parity, or occupation, though housewives had more negative cultures.
Keywords. *Urinary Tract Infection, Prevalence, Pregnancy, Antibiotic Susceptibility, Risk Factors.*

Received*: 09/11/25*
Accepted*: 10/01/26*
Published*: 20/01/26*

Introduction

Pregnancy heightens urinary tract infection (UTI) risk through physiological changes, primarily urinary stasis and vesicoureteral reflux from mechanical and hormonal factors. A short urethra and hygiene difficulties because of a distended belly compound this. UTIs, the most common bacterial infection, affect about 8% of pregnant women [1]. Poor genital hygiene, urination habits, as well as low socioeconomic status, significantly contribute and are often linked to inadequate knowledge of risk factors and prevention strategies [2]. Untreated UTIs during pregnancy pose severe risks, including low birth weight, preterm labor, intrauterine growth retardation, intrauterine fetal death, premature birth, in addition to raised perinatal death and morbidity. Maternal complications may include preeclampsia, encompassing anemia, septicemia, renal failure, in addition to adult respiratory distress syndrome [3].

The gold standard for UTI diagnosis involves detecting pathogens in urine alongside clinical symptoms, especially in cases of non-specific presentation. Urine culture identifies the pathogen and quantifies bacteriuria, with a threshold of ≥10^3 CFU/mL indicating infection, accompanied by significant pyuria [4]. Thus, routine screening for asymptomatic bacteriuria (ASB) in gestation—regardless of symptoms—is crucial in primary care to enable early intervention and avert complications. Both Gram-negative and Gram-positive bacteria predominate as causes of ASB during pregnancy [5].

UTIs in females, whether pregnant or not, share the same causative organisms and virulence factors. Common isolates involve *Klebsiella pneumoniae, Escherichia coli, Acinetobacter*, *Proteus, Group B Streptococcus* (GBS), and *Staphylococcus saprophyticus,* in addition to *Pseudomonas aeruginosa* [6]. Antibiotics are vital for global UTI management but are threatened by resistance, primarily driven by excessive and unnecessary use, endangering public health [7]. During pregnancy, beta-lactam antibiotics like cephalosporin and penicillin are usually safe and frequently prescribed for effective treatment [8]. This research aimed to detect the occurrence and risk factors of urinary tract infection during pregnancy and the microorganism associated with it.

Methodology

Patients and methods

This study was approved by the Libyan Authority for Scientific Research - General Commission for Bioethics and Biosafety - Biomedical Ethics Committee of Al-Bayda Campus, University of Omar Al-Mukhtar – Libya. (NBC:007. H. 25.64). This cross-sectional research has been performed on 100 women at private clinics in El Jabal Al Khdar, Al Byda, Libya, from January 2025 to September 2025.

Inclusion criteria: All pregnant women with or without UTI were supplied with written consent.

Exclusion criteria: Pregnant women who failed to produce urine and those with vaginal bleeding, pregnant women who have diabetes mellitus or renal pathology, and pregnant women who had established antimicrobial treatment within 2 weeks from this study were excluded.

Methods

Data Collection

Demographic variables (age, residence, educational level), obstetric history (gestational age, trimester classification, gravidity, parity), occupational status, and clinical symptoms: Presence or absence of UTI-related symptoms, including lower abdominal pain, urinary frequency, dysuria, fever, and hematuria, all these variables were collected by using a well-structured questionnaire.

Procedures

Urine Sample Collection

Midstream urine samples have been gathered using standard sterile technique: external genitalia were cleaned with sterile wipes, the first portion of urine was discarded, midstream urine (approximately 20-30 mL) was collected in sterile containers, and the samples were transported to the laboratory within two hours of collection or refrigerated at 4°C if delayed.

Urine culture and bacterial identification

Urine cultures have been produced in accordance with the standard microbiological methods. These methods included the count of the colony, the number of organisms grown in culture, and the utilization of quick biochemical tests, as well as the utilization of automated confirmatory tests. A quantitative streak technique has been utilized to inoculate one µL of urine onto a biplate media consisting of MacConkey agar and sheep blood agar. Upon incubation for a period of twenty-four hours, at 37 ^{o}C, the identification of uropathogen colonies has been carried out through the utilization of colony morphology, biochemical tests, growth patterns, as well as Gram staining. A Vitek2 instrument system (BioMérieux, France) has been used with a 0.5 McFarland standard inoculum to carry out confirmatory identification and colony counts, as well as antibiotic susceptibility tests. These procedures have been carried out in accordance with the manufacturer's recommendations.

Antimicrobial susceptibility testing

Antibiotic susceptibility tests have been performed according to the breakpoints and panels established by the Clinical and Laboratory Standards Institute (CLSI). The detection of extended-spectrum beta-lactamase (ESBL) resistance in isolated uropathogens has been performed using the Vitek2 instrument, specifically assessing resistance to third-generation cephalosporins, namely ceftazidime or ceftriaxone.

Study outcomes and definitions: occurrence of UTI

defined as the proportion of pregnancies exhibiting positive urine culture results with bacterial growth of above or equal to 10^3 colony-forming units (CFU)/mL, indicative of bacteriuria consistent with UTI.

Identification of associated microorganisms

including predominant uropathogens isolated from positive urine cultures such as *Escherichia coli, Staphylococcus spp., Streptococcus spp.*, and any mixed growth patterns.

Assessment of antibiotic susceptibility and resistance patterns

evaluating in vitro sensitivity and resistance of isolated uropathogens to a panel of antibiotics (e.g., ciprofloxacin, ceftriaxone, amoxicillin) according to Clinical and Laboratory Standards Institute (CLSI) breakpoints, along with recognition of extended-spectrum beta-lactamase (ESBL) production.

Statistical analysis

Information has been fed to the computer and analyzed utilizing IBM SPSS software package version 25.0 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). The qualitative information has been expressed utilizing numbers and percentages. The Shapiro-Wilk test has been utilized to assess the normality of the distribution. Quantitative information has been defined by range (maximum and minimum), mean, standard deviation, or median (IQR). The significance of the outcomes gained has been evaluated at the five percent level. The tests utilized were: the Chi-square test, utilized for categorical variables to compare different groups. Monte Carlo correction of Fisher's exact test: utilized for correction for chi-square when over twenty percent of the cells have expected count below 5. Mann-Whitney's Test (U test) has been utilized to evaluate the statistical significance of the variance of a non-parametric numerical variable between two examined groups.

Results

(Table 1) shows that the age of participants ranged from 18 to 42 years, with a median age of 29 years (IQR: 25.5–33). The largest proportion of women (46%) was in the 26–33-year age group, followed by 28% in the 18–25-year group and 26% in the 34–42-year group. Regarding residence, the majority of participants (72%) lived in Al-Bayda, while 28% came from outside the city. The gestational age of participants ranged from 5 to 38 weeks, with a median of 20 weeks (IQR: 12–30). The second trimester included the highest proportion of women (41%), followed by the third trimester (33%) and the first trimester (26%). Most participants were multigravida (76%), with a median gravidity of 3 (IQR: 2–5) and a range of 1–9. Similarly, 73% were multiparous, with parity ranging from 0 to 8 and a median of 2 (IQR: 0–3). In terms of occupation, housewives represented the majority (63%) compared to 37% who were employed. Clinically, 67% of the participants presented with UTI-related symptoms, while 33% were asymptomatic. The most common clinical symptom was lower abdominal pain (LAP), reported by 47% of cases, followed by urinary frequency (37%) and dysuria (30%). Fever (7%) and hematuria (5%) were less frequent. Microscopic urine examination showed that 67% of cases had 1–10 pus cells per high-power field.

Table 1. Demographic, obstetric, and clinical characteristics of pregnant women.

Parameters	**Studied cases (N= 100)**	
	N	**%**
Age group		
18–25 years	28	28.0
26–33 years	46	46.0
34–42 years	26	26.0
Age (years)		
Median (IQR)	29 (25.5- 33)	
Range	18- 42	
Residence		
Al-Bayda	72	72.0
Outside Al-Bayda	28	28.0
Gestational age (weeks)		
Median (IQR)	20 (12- 30)	
Range	5- 38	
Trimester		
1st trimester	26	26.0
2nd trimester	41	41.0
3rd trimester	33	33.0
Gravidity		
Median (IQR)	3 (2- 5)	

Range	1- 9	
Multigravida	76	76.0
Parity		
Median (IQR)	2 (0- 3)	
Range	0- 8	
Multipara	73	73.0
Occupation		
Housewife	63	63.0
Employed	37	37.0
Symptoms		
No	33	33.0
Yes	67	67.0
Clinical symptoms		
LAP	47	47.0
Frequency	37	37.0
Dysuria	30	30.0
Fever	7	7.0
Hematuria	5	5.0
Pus cells		
1-10	67	67.0
11-20	16	16.0
21-30	9	9.0
41-50	2	2.0
50-60	3	3.0
>60	3	3.0

IQR: Interquartile range

Table 2 shows that among the 100 pregnant women studied, bacterial growth indicative of UTI was detected in 80% of cases, whereas 20% showed no bacterial growth. Among the 80 positive cultures, *Escherichia coli* has been the most isolated organism, accounting for 46.3% of the cases. *Staphylococcus* species were the second most common isolates (20%), followed by *Streptococcus* species (18.8%). Less frequent isolates include *Proteus* (7.5%) and *Klebsiella* (5%). Mixed bacterial growth involving *E. coli* and *Staphylococcus* was detected in 2.5% of cases, as shown in (Figure 1).

Table 2. Occurrence of urinary tract infection and bacterial isolates between pregnancies.

Parameters	**Studied cases (N= 100)**	
	N	**%**
Bacterial growth (UTI)		
No	20	20.0
Yes	80	80.0
Isolated bacteria (N=80)		
E. coli	37/80	46.3
Staphylococcus	16/80	20.0
Streptococcus	15/80	18.8
Proteus	6/80	7.5
Klebsiella	4/80	5.0
Mixed growth (E. coli+Staph.)	2/80	2.5

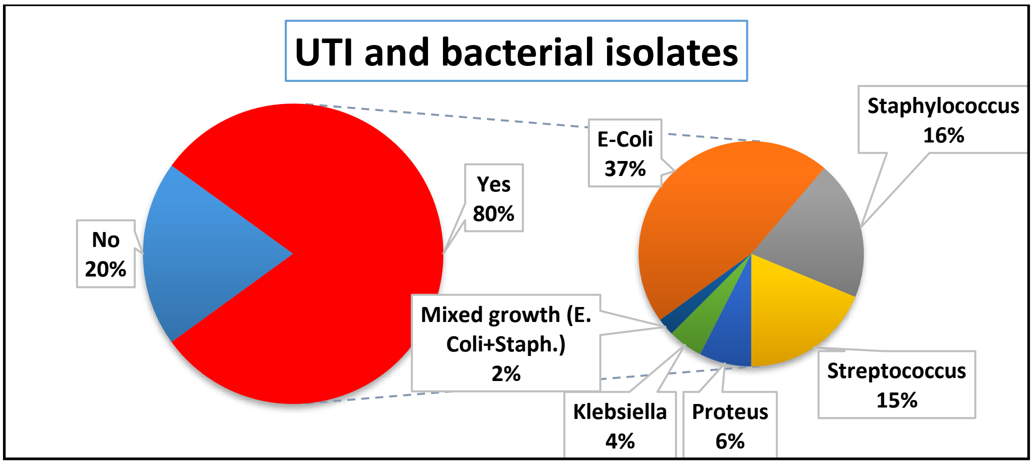

Figure 1. Prevalence of urinary tract infection and bacterial isolates among pregnant women.

Table 3 shows a comparison of pregnancies with and without UTIs in terms of demographic, obstetric, and clinical variables. Women with UTI underwent a significantly greater median age (29 years, IQR: 27–34) in comparison with those without UTI (27 years, IQR: 23.5–30.5; P-value equal to 0.034). Insignificant variances have been detected according to residence, education level, gestational age, trimester, gravidity, parity, or occupation (P>0.05 for all). Symptomatic presentation was significantly more common among women with UTI (76.3% vs. 30%; P<0.001). Analysis of urine revealed that women with UTI had higher pus cell counts, with 1–10 cells observed in 53.8% compared to 95% in the non-UTI group (P=0.041), and 11–20 cells or higher observed only in the UTI group.

Table 3. Comparison of demographic, obstetric, and clinical characteristics between pregnancies with and without urinary tract infection.

Variables	No UTI (N= 20)		UTI (N= 80)		P-value
	N	%	N	%	
Age group					
≤ 20 years	4	20.0	2	2.5	0.031‡MC
21-25	6	30.0	13	16.3	
26-30	5	25.0	32	40.0	
31-35	3	15.0	17	21.3	
36-40	2	10.0	12	15.0	
> 40 years	0	0.0	4	5.0	
Age (years)					
Median (IQR)	27 (23.5- 30.5)		29 (27- 34)		0.034†
Range	18- 39		20- 42		
Residence					
Al-Bayda	13	65.0%	59	73.8%	0.436‡
Outside Al-Bayda	7	35.0%	21	26.3%	
Education					
Basic education	15	75.0	69	86.3	0.303FET
Higher education	5	25.0	11	13.8	
Gestational age (weeks)					
Median (IQR)	17 (15- 31.5)		21.5 (12- 29.5)		0.727†
Range	8- 37		5- 38		
Trimester					
1st trimester	3	15.0	23	28.7	0.297‡
2nd trimester	11	55.0	30	37.5	
3rd trimester	6	30.0	27	33.8	
Gravidity					
Median (IQR)	2 (1- 4)		3 (2- 5)		0.160†

Razi Med J. 2026;2(1):35-45
https://doi.org/10.69667/rmj.26106
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

Range	1- 9		1- 8		
Multigravida	14	70.0	62	77.5	0.560‡
Parity					
Median (IQR)	1 (0- 2)		2 (0.5- 3.5)		0.095†
Range	0- 8		0- 7		
Multipara	13	65.0	60	75.0	0.404‡
Occupation					
Housewife	14	70.0	49	61.3	0.468‡
Employed	6	30.0	31	38.8	
Symptoms					
No	14	70.0	19	23.8	<0.001‡
Yes	6	30.0	61	76.3	
Pus cells/HPF					
1-10	19	95.0	43	53.8	0.041‡MC
11-20	0	0.0	16	20.0	
21-30	1	5.0	13	16.3	
41-50	0	0.0	2	2.5	
50-60	0	0.0	3	3.8	
>60	0	0.0	3	3.8	

p-value above 0.05 is non-significant; p-value below or equal to 0.05 is significant. UTI: urinary tract infection†Mann-Whitney U Test, ‡ Chi-square test, FET: Fisher's Exact Test, MC: Monte-Carlo correction, IQR: Interquartile range

Table 4 shows that the logistic regression was carried out to detect factors related to UTI between pregnancies. In univariate analysis, age (P=0.020), presence of symptoms (P-value below 0.001), and pus cell count (P-value equal to 0.026) were significantly related to UTI. Multivariate analysis showed that symptomatic presentation remained an independent predictor of UTI (adjusted odds ratio [AOR]=5.31; ninety-five percent CI: 1.586–17.771; P-value equal to 0.007). Other variables, including age, residence, gestational age, gravidity, parity, education, occupation, and pus cell count, were not statistically significant after adjustment (P>0.05).

Table 4. Univariate and multivariate logistic regression analysis of factors related to UTI in pregnancies.

Parameters	Univariate				Multivariate			
	P-value	COR	95%CI		P-value	AOR	95%CI	
			Lower limit	Upper limit			Lower limit	Upper limit
Age	0.020	1.126	1.019	1.245	0.550	1.048	0.898	1.224
Residence	0.438	1.513	0.532	4.302	0.128	2.874	0.737	11.211
Gestational age	0.741	1.009	0.959	1.061	0.396	0.972	0.912	1.037
Gravidity	0.207	1.183	0.911	1.536	0.582	0.731	0.240	2.229
Parity	0.163	1.223	0.922	1.622	0.364	1.720	0.533	5.547
Education	0.227	0.478	0.145	1.581	0.431	0.481	0.078	2.974
Occupation	0.470	1.476	0.513	4.247	0.582	1.450	0.387	5.431
Symptoms	<0.001	7.491	2.528	22.196	0.007	5.310	1.586	17.771
Pus cells	0.026	1.160	1.018	1.321	0.053	1.151	0.998	1.327

B: Regression coefficient; S.E.: Standard error, COR: Crude Odds ratio, CI: Confidence interval, AOR: Adjusted Odds ratio

(Table 5) demonstrates a heterogeneous antibiotic susceptibility pattern among *E. coli* isolates. Among the classes, macrolides (azithromycin, erythromycin) and folate pathway inhibitors (Septrin/co-trimoxazole) showed the highest sensitivity rates (85% and 84%, respectively), indicating relatively preserved activity. β-lactams (ampicillin, amoxicillin, augmentin, carbenicillin) and fluoroquinolones (ciprofloxacin, levofloxacin, norfloxacin, moxifloxacin, nalidixic acid) demonstrated moderate sensitivity, with 75% and 73%, respectively, although resistance was notable for fluoroquinolones (27%) and β-lactams (25%). Cephalosporins retained moderate efficacy with 63% sensitivity, whereas aminoglycosides showed limited effectiveness (37% sensitivity), reflecting significant resistance (63%). The lowest

Razi Med J. 2026;2(1):35-45
https://doi.org/10.69667/rmj.26106
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

activity was observed among nitrofurans (nitrofurantoin) and carbapenems (imipenem, meropenem), with sensitivity rates of 5% and 7%, respectively, and high resistance exceeding 90%, highlighting emerging multidrug resistance.

Table 5. The percentage of antibiotic sensitivity and resistance patterns of E. coli.

Antibiotics	Sensitive (%)	Resistant (%)
Fluoroquinolones (Ciprofloxacin, Levofloxacin, Norfloxacin, Moxifloxacin, Nalidixic acid)	73	27
β-lactams (Penicillins ± inhibitor) (Ampicillin, Amoxicillin, Augmentin, Carbenicillin)	75	25
Cephalosporins (Ceftriaxone, Cefixime)	63	37
Aminoglycosides (Gentamicin, Amikacin, Neomycin)	37	63
Macrolides (Azithromycin, Erythromycin)	85	15
Folate pathway inhibitors (Septrin / Co-trimoxazole)	84	16
Nitrofuran (Nitrofurantoin)	5	95
Carbapenems (Imipenem, Meropenem)	7	93
Antibiotic class	Sensitive (%)	Resistant (%)

(Table 6) summarizes the antibiotic susceptibility of *Staphylococcus* isolates by drug class, revealing variable resistance patterns across different antimicrobial groups. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin, nalidixic acid) and cephalosporins (ceftriaxone, cefotaxime, cefixime, cefoxitin) showed the highest sensitivity rates, each at 61.1%, suggesting moderate efficacy of these classes against the studied isolates. Macrolides (azithromycin, erythromycin) also demonstrated a reasonable sensitivity of 55.6%.
In contrast, β-lactams (amoxicillin, ampicillin) exhibited a higher resistance rate (55.6%), reflecting significantly reduced susceptibility. Notably, other commonly used agents showed limited effectiveness: nitrofurantoin and the “others” category (chloramphenicol, fusidic acid) had sensitivity of only 11.1%, whereas aminoglycosides (amikacin, tobramycin, neomycin) and carbapenems (imipenem) demonstrated extremely low sensitivity (5.6%) and very high resistance (>94%). Folate pathway inhibitors (co-trimoxazole/Septrin) displayed minimal activity with only 5.6% sensitivity.

Table 6. The percentage of antibiotic sensitivity and resistance patterns of Staphylococcus.

Antibiotics	Sensitive (%)	Resistant (%)
Fluoroquinolones		
(Ciprofloxacin, Levofloxacin, Moxifloxacin, Nalidixic acid)	61.1	38.9
β-lactams (Penicillins ± β-lactamase inhibitor)		
(Amoxicillin, Ampicillin, Augmentin)	44.4	55.6
Cephalosporins		
(Ceftriaxone, Cefotaxime, Cefixime, Cefoxitin)	61.1	38.9
Macrolides		
(Azithromycin, Erythromycin)	55.6	44.4
Nitrofurantoin	11.1	88.9
Folate pathway inhibitors		
(Co-trimoxazole / Septrin)	5.6	5.6
Carbapenems		
(Imipenem)	5.6	94.4
Aminoglycosides		
(Amikacin, Tobramycin, Neomycin)	5.6	94.4
Others		
(Chloramphenicol, Fusidic acid)	11.1	88.9

Table 7 presents the antibiotic susceptibility patterns of *Streptococcus* isolates, grouped by drug class, revealing notable variation in sensitivity. Fluoroquinolones (ciprofloxacin, levofloxacin) exhibited the highest activity, with 80% of isolates being sensitive, followed by cephalosporins (cefotaxime, ceftriaxone) at 66.7%, indicating these classes retain

Razi Med J. 2026;2(1):35-45
https://doi.org/10.69667/rmj.26106
Razi Medical Journal
https://razi.edu.ly/rmj/index.php/hm

considerable efficacy. Augmentin showed moderate activity with 46.7% sensitivity, whereas aminoglycosides (gentamicin, amikacin, tobramycin, and neomycin) demonstrated lower sensitivity at 40%.
Resistance was pronounced among several classes. Macrolides (azithromycin, erythromycin, clarithromycin) exhibited 66.7% resistance, while nitrofurantoin showed 73.3% resistance. Tetracyclines (tetracycline, doxycycline) and clindamycin displayed the highest resistance rates at 86.7% and 93.3%, respectively, indicating these agents are largely ineffective against the studied isolates. Imipenem also showed limited efficacy, with only 20% sensitivity.

Table 7. The percentage of antibiotic sensitivity and resistance patterns of Streptococci.

Antibiotics	Sensitive (%)	Resistant (%)
Ciprofloxacin, Levofloxacin	80	20
Cefotaxime, Ceftriaxone	66.7	33.3
Augmentin	46.7	53.3
Imipenem	20	80
Gentamicin, Amikacin, Tobramycin, Neomycin	40	60
Azithromycin, Erythromycin, Clarithromycin	33.3	66.7
Nitrofurantoin	26.7	73.3
Tetracycline, Doxycycline	13.3	86.7
Clindamycin	6.7	93.3

Table 8 summarizes the antibiotic susceptibility of *Klebsiella* isolates by drug class, revealing variable patterns of sensitivity and resistance. Among the tested antibiotics, fluoroquinolones (ciprofloxacin, levofloxacin, nalidixic acid) exhibited the highest sensitivity at 75%, indicating relatively preserved activity. Moderate sensitivity was observed for cephalosporins (ceftriaxone), macrolides (azithromycin, erythromycin), aminoglycosides (gentamicin, amikacin), and penicillins (amoxicillin, ampicillin, carbenicillin), each showing 50% sensitivity, reflecting an equal distribution of susceptible and resistant isolates.
Lower activity was noted for chloramphenicol, with only 25% sensitivity, while vancomycin demonstrated no activity against *Klebsiella* (0% sensitivity, 100% resistance), consistent with its intrinsic inactivity against Gram-negative organisms.

Table 8. The percentage of antibiotic sensitivity and resistance patterns of Klebsiella.

Antibiotics	Sensitive (%)	Resistant (%)
Fluoroquinolones		
(Ciprofloxacin, Levofloxacin, Nalidixic acid)	75	25
Cephalosporins		
(Ceftriaxone)	50	50
Macrolides		
(Azithromycin, Erythromycin)	50	50
Aminoglycosides		
(Gentamicin, Amikacin)	50	50
Penicillins		
(Amoxicillin, Ampicillin, Carbenicillin)	50	50
Others		
(Chloramphenicol)	25	75
Glycopeptides		
(Vancomycin)	0	100

Table 9 summarizes the antibiotic susceptibility of *Proteus* isolates across different drug classes. Among the tested agents, fluoroquinolones (ciprofloxacin) and cephalosporins (cefotaxime, ceftriaxone) demonstrated the highest activity, with 83.3% of isolates being sensitive, indicating strong efficacy. Nitrofurantoin also retained moderate activity with 66.7% sensitivity. Interestingly, the “others” category (fusidic acid) showed unexpectedly high sensitivity (83.3%), although its clinical relevance against Gram-negative *Proteus* may be limited. Conversely, carbapenems (imipenem) displayed reduced effectiveness, with only 33.3% sensitivity and 66.7% resistance. Aminoglycosides (neomycin) and β-lactams (amoxicillin, oxacillin) demonstrated low sensitivity (16.7%), reflecting considerable resistance, while folate pathway inhibitors (Septrin/co-trimoxazole) showed moderate resistance at 66.7%.

Table 9. The percentage of antibiotic sensitivity and resistance patterns of Proteus.

Antibiotics	Sensitive (%)	Resistant (%)
Fluoroquinolones		
(Ciprofloxacin)	83.3	16.7
Cephalosporins		
(Cefotaxime, Ceftriaxone)	83.3	16.7
Nitrofurantoin	66.7	33.3
Carbapenems		
(Imipenem)	33.3	66.7
Aminoglycosides		
(Neomycin)	16.7	83.3
β-lactams (Penicillins ± inhibitor)		
(Amoxicillin, Augmentin, Oxacillin)	16.7	33.3
Folate pathway inhibitors		
(Septrin / Co-trimoxazole)	33.3	66.7
Others		
(Fusidic acid)	83.3	16.7

Discussion

The study included 100 pregnant women with a median age of twenty-nine years, mostly residing in Al-Bayda (72%). The median gestational age was 29 weeks, with participants distributed across all trimesters. Most were multigravida (76%) and multipara (73%), and the majority were housewives (63%). Clinically, 67% reported urinary symptoms, most commonly lower abdominal pain (47%), urinary frequency (37%), and dysuria (30%). Laboratory analysis revealed mild pyuria in the majority, with 67% showing 1–10 pus cells per high-power field.

This outcome was in line with Ngong *et al.,* who examined the occurrence and risk factors for urinary tract infections, the diagnostic probability of dipstick analyses, and the antimicrobial susceptibility of uropathogens from pregnancies with presence antenatal consultation (ANC) [9]. They revealed that the majority (65.9%) of participants in their cohort were in the 21–30 years' age group and (61.7%) were multigravida, and (58.8 %) were multipara. Similarly, consistent with Ezo *et al.,* who assessed the risk factors and occurrence of UTI between pregnancies attending antenatal care at Wachemo University. They reported that most participants were aged 25–29 years (36.8%) and resided in urban areas (70.9%). In addition, the majority were multigravida (72.1%), multipara (59.5%), and housewives (71.6%) [10].

The present study shown a great occurrence of UTI in 80% of pregnancies, with *E. coli* being the most often isolated organism, followed by *Staphylococcus* and *Streptococcus*. The antibiotic sensitivity pattern illustrated that the majority of isolates were greatly sensitive to ciprofloxacin, ceftriaxone, and Augmentin, while marked resistance was observed against amoxicillin and ampicillin. These results indicate that fluoroquinolones and third-generation cephalosporins remain the most effective therapeutic options, whereas beta-lactam antibiotics show declining efficacy. The findings emphasize the importance of continuous monitoring of bacterial patterns and antibiotic susceptibility to guide empirical treatment and prevent antimicrobial resistance in pregnancies with UTIs.

These results were consistent with those of Mohamed *et al.,* who determined the occurrence and risk factors of UTI between pregnancies in Ismailia city, Egypt. They reported that the most common organism in positive infected cases was *E. coli,* followed by *Staphylococcus aureus* [11]. Similarly, Lee *et al.,* who define the population-based occurrence, risk factors, and cause, in addition to antimicrobial resistance patterns of UTI in gestation in Bangladesh. They found that *E. coli* was the predominant uropathogen with low susceptibility to ampicillin and azithromycin, while nitrofurantoin remained among the most effective antibiotics [12].

In contrast with Mahmoud et al., who assessed the occurrence of UTIs among 440 pregnancies at the Faculty of Nursing, Sohag University, Egypt. They observed that the occurrence of UTI between the pregnancies was 42.3 percent [13]. The higher occurrence detected in this research might be attributed to variations in sample size, geographic location, and population characteristics.

The present research validated a statistically significant association between age and the presence of UTI between pregnancies, where infection was more frequent in older age groups (p = 0.031). Similarly, the median age was significantly higher among those with UTI. Insignificant variances have been detected according to residence, education, gestational age, gravidity, parity, or occupation, indicating that these variables were not major contributing factors to infection in this sample. A strong correlation was noted among the presence of symptoms and UTI ($p < 0.001$), suggesting that symptomatic presentation is a reliable indicator of infection. Furthermore, a significant increase in pus cell count was observed among infected women (p = 0.041), supporting the diagnostic value of microscopic urine analysis in detecting UTIs during pregnancy. These results were consistent with a previous study that investigated the risk factors of UTI during pregnancy. They reported that the proportions of cases in the UTI group who were above or equal to thirty-five years old were significantly greater than the non-urinary tract infection group (p-value below 0.05) [14]. Similarly, in agreement with Umar *et al.*, who determined the clinical significance of bacteriuria in correlation to its complications with an intention to negate the untoward impact of the illness on the pregnancies and the growing fetus. They revealed that 65.38% of culture-positive cases demonstrated more than 3 pus cells/HPF, further emphasizing that increased leukocyturia is a reliable marker for infection [15].
Logistic regression analysis showed that only symptoms and pus cells were significantly related to urinary tract infection between pregnancies. In the univariate model, both were significant (symptoms and pus cells). Following adjustment, symptoms remained an independent predictor, while pus cells showed a borderline association. Other factors, including age, residence, gestational age, gravidity, parity, education, and occupation, were not significantly linked to UTI risk. In contrast with Vicar *et al.*, which their multivariate logistic regression analysis revealed that higher gravidity and parity levels were strongly associated with increased UTI risk [16]. These results were in line with Werter *et al.*, who identified several potential risk factors for UTI during pregnancy. Their univariate logistic regression analysis showed that maternal age and the presence of asymptomatic bacteriuria (ASB) were significantly related to UTI occurrence. Likewise, in the multivariate analysis, the presence of ASB during pregnancy was found to nearly double the risk of developing a UTI [17].

Conclusion

High UTI prevalence (80%, predominantly *E. coli*) among pregnant women at Libyan private antenatal clinics. Infected women were older, more symptomatic, and showed higher pus cell counts. No significant associations with residence, education, gestational age, trimester, gravidity, parity, or occupation—though housewives had more negative cultures. Trimester-unaffected bacterial isolates. Multivariate analysis identified symptomatic presentation as the sole independent predictor.

Conflict of interest. Nil

References

1. Getaneh T, Negesse A, Dessie G, Desta M, Tigabu A. Prevalence of urinary tract infection and its associated factors among pregnant women in Ethiopia: a systematic review and meta-analysis. Biomed Res Int. 2021;2021:6551526.
2. Obeagu EI, Ofodile AC, Okwuanaso CB. A review of urinary tract infections in pregnant women: risks factors. J Public Health Nutr. 2023;6(1):137-9.
3. Ali AH, Reda DY, Ormago MD. Prevalence and antimicrobial susceptibility pattern of urinary tract infection among pregnant women attending Hargeisa Group Hospital, Hargeisa, Somaliland. Sci Rep. 2022 Feb 23;12(1):1419.
4. Johnson B, Stephen BM, Joseph N, Asiphas O, Musa K, Taseera K. Prevalence and bacteriology of culture-positive urinary tract infection among pregnant women with suspected urinary tract infection at Mbarara regional referral hospital, South-Western Uganda. BMC Pregnancy Childbirth. 2021 Mar 5;21(1):159.
5. Abu D, Abula T, Zewdu T, Berhanu M, Sahilu T. Asymptomatic bacteriuria, antimicrobial susceptibility pattern and associated risk factors among pregnant women attending antenatal care in Assosa General Hospital, Western Ethiopia. BMC Microbiol. 2021 Dec 18;21(1):348.
6. Balachandran L, Jacob L, Al Awadhi R, Yahya LO, Catroon KM, Soundararajan LP. Urinary tract infection in pregnancy and its effects on maternal and perinatal outcome: a retrospective study. Cureus. 2022 Jan;14(1):e21559.
7. Yeta KI, Michelo C, Jacobs C. Antimicrobial resistance among pregnant women with urinary tract infections attending antenatal clinic at Levy Mwanawasa University Teaching Hospital (LMUTH), Lusaka, Zambia. Int J Microbiol. 2021 Dec 11;2021:8884297.
8. Salari N, Khoshbakht Y, Hemmati M, Khodayari Y, Khaleghi AA, Jafari F, et al. Global prevalence of urinary tract infection in pregnant mothers: a systematic review and meta-analysis. Public Health. 2023 Mar;224:58-65.

9. Ngong IN, Fru-Cho J, Yung MA, Akoachere JF. Prevalence, antimicrobial susceptibility pattern and associated risk factors for urinary tract infections in pregnant women attending ANC in some integrated health centers in the Buea Health District. BMC Pregnancy Childbirth. 2021 Oct 21;21(1):673.
10. Ezo E, Binora H, Solomon F, Zekiwos A, Mezgebu T, Admasu S, et al. Risk factors and prevalence of urinary tract infection among pregnant women attending antenatal care at Wachemo University Comprehensive Specialized Hospital. SAGE Open Nurs. 2024 Apr 3;10:23779608241264172.
11. Mohamed NR, Omar H, Abd-Allah IM. Prevalence and risk factors of urinary tract infection among pregnant women in Ismailia City, Egypt. IOSR J Nurs Health Sci. 2017;6(3):62-72.
12. Lee AC, Mullany LC, Koffi AK, Rafiqullah I, Khanam R, Folger LV, et al. Urinary tract infections in pregnancy in a rural population of Bangladesh: population-based prevalence, risk factors, etiology, and antibiotic resistance. BMC Pregnancy Childbirth. 2020 Jan 6;20(1):1.
13. Mahmoud MA, Kamel AD, Ahmed SI, El-Hamed AA. Prevalence of urinary tract infections among pregnant women at Sohag University Hospital. Egypt Nurs J. 2019;16(3):162-74.
14. Shen W, Zhu L. Analysis of risk factors for urinary tract infections in pregnant women: a retrospective study. Arch Esp Urol. 2024 Jun;77(5):525-530.
15. Umar N, Kulsum SN, Ali L. Spectrum of urinary tract infections in pregnant women. Biomed Pharmacol J. 2015;6(2):349-53.
16. Vicar EK, Acquah SE, Wallana W, Kuugbee ED, Osbutey EK, Aidoo A, et al. Urinary tract infection and associated factors among pregnant women receiving antenatal care at a primary health care facility in the northern region of Ghana. Int J Microbiol. 2023 Nov 20;2023:3727265.
17. Werter DE, Kazemier BM, Schneeberger C, Mol BW, de Groot CJ, Geerlings SE, et al. Risk indicators for urinary tract infections in low risk pregnancy and the subsequent risk of preterm birth. Antibiotics (Basel). 2021 Aug 31;10(9):1055.