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Original article

Assessment of the Bacterial Profile and Antimicrobial Susceptibility Outcomes among Pregnant Women with Urinary Tract Infection at Tripoli, Libya

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Abstract
Urinary tract infection (UTI) is considered the most common bacterial infection among pregnant women. UTIs during pregnancy are responsible for substantial maternal and fetal complications. Two-thirds of pregnant women with UTI require effective antibiotics to treat this condition. This study was conducted to describe the bacterial profile and antimicrobial susceptibility patterns among pregnant women with urinary tract infections in Tripoli, Libya, in 2025. This was a descriptive cross-sectional study conducted across multiple centers, healthcare facilities, and diagnostic laboratories in Tripoli, Libya, over six months from January to June 2025. After obtaining ethical approval from selected centers, this study included 143 pregnant women who were diagnosed with urinary tract infection and underwent a urine culture test during that time period. The data were encoded and analyzed using a computerized program of SPSS version 26. In this study, the most frequent maternal age was 43.36% (62), between 17-25 years. The majority of cases were multigravida, accounting for 76.93% (110), while 23.07% (33) of them were primigravida. Most cases were in the second trimester, accounting for 43.36% (62). The most predominant uropathogen was E. coli, which accounted for 33.56% (48), followed by 18.18% (26) identified as Klebsiella pneumoniae. Almost all uropathogens had good sensitivity to Gentamicin and imipenem, as well as some of them to ceftriaxone. Frequent antibiotic resistance to Nitrofurantoin, Amoxicillin, Amoxicillin/Clavulanic acid, and Ciprofloxacin was detected, particularly among E. coli and Klebsiella pneumoniae. In summary, the most frequent uropathogen among pregnant women was E. coli (33.56%) followed by Klebsiella pneumoniae (18.18%). The majority of uropathogens exhibited the highest sensitivity for Gentamicin, imipenem, and ceftriaxone, which suggested effective treatment outcomes when clinically indicated. Conversely, notable resistance patterns to commonly prescribed antibiotics such as nitrofurantoin, amoxicillin, Amoxicillin/Clavulanic acid, and Ciprofloxacin, reflecting the ongoing global concern regarding antibiotic misuse and the emergence of multidrug-resistant uropathogens. Several factors suggested to be implicated in this condition include younger age, Multigravidity, second trimester, and suspected overuse of antibiotics that leads to multidrug resistance. Therefore, early detection of urinary tract infection for high-risk cases is an essential approach to achieve optimal effective management outcomes and to reduce adverse perinatal outcomes.
Keywords. Urinary tract infection, UTI, Antibiotics, Antimicrobial resistance, Libya.

Introduction

Urinary tract infection (UTI) is considered the most common bacterial infection among pregnant women, which includes asymptomatic bacteriuria (ABU) and symptomatic infections of the bladder (cystitis) or kidney (pyelonephritis) (1-3). According to the World Health Organization (WHO), the estimated prevalence of urinary tract infection in pregnancy reached 28% (4).

Usually, the UTI begins at week 6 and peaks during weeks 22 to 24 of pregnancy as a result of numerous factors, including urethral dilatation, increased bladder volume, decreased bladder tone and decreased urethral tone, which contribute to raised urinary stasis and ureterovesical reflux. Moreover, 70 % of pregnant women express glycosuria that enhances bacterial growth in the urine (5). Various maternal factors were recognized to be associated with an increased rate of UTI, such as age, multiparity, gestational age, anemia, decreased immunity, sexual activity, history of genitourinary abnormalities, previous history of UTI and lower socioeconomic classes (6-7). UTIs during pregnancy are responsible for substantial maternal and fetal complications such as premature rupture of membranes, preterm uterine contractions, preterm delivery, renal abscess formation, maternal sepsis, acute respiratory distress syndrome (ARDS), disseminated intravascular coagulation (DIC), and intensive care unit (ICU) admission (8-9).

Clinical guidelines recommend that healthcare providers should screen all pregnant women for asymptomatic bacteriuria because, if left untreated, it may be a common risk factor for pyelonephritis. Additionally, two-thirds of pregnant women with UTI require effective antibiotics to treat this condition. (10-18) But variable levels of antibiotic sensitivity and resistance have been documented in several studies (19). The present study aims to describe the bacterial profile and antimicrobial susceptibility outcomes among pregnant women with urinary tract infection at Tripoli, Libya, 2025.

Methods

This study was descriptive cross-sectional study which carried out at multi-centers sectors across various healthcare facilities and diagnostic laboratories (Alyashfeen Specialized Clinic, Al-Osra Medical Center, Al-Moafi Specialized Hospital,

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Aldreibi Laboratory, Nour Alhayat Fertility Lab, Adam Medical Laboratory, Al-Assema Specialized Hospital, Alboshra Clinic for Women, Children and Obstetrics, Genetec Lab, Alshorouq Lab, Alrayan Specialized Clinic, and Ghot Alshaal Specialized Hospital) in Tripoli, Libya, over a six-month period from January to June 2025.

After obtaining ethical approval from selected centers, this study included 143 pregnant women who were diagnosed by urinary tract infection and underwent a urine culture test during that time period.

- Inclusion Criteria: Libyan pregnant women diagnosed with UTIs during the study period.
- Exclusion Criteria: Non-Libyan, cases of recurrent UTIs or those who had received antibiotics within two weeks prior to urine culture collection.

The data collected via simple random sampling techniques through a standardized questionnaire by investigators. The bacterial identification was carried out in a professional laboratory that used suitable media for cultures. Incubation conditions adhered to established microbiological standards, typically maintained at 35-37°C for a duration of 24 to 48 hours. Biochemical tests were conducted to verify the identity of the isolated organisms, in accordance with guidelines set forth by the Clinical and Laboratory Standards Institute (CLSI). Also, antibacterial susceptibility was determined following universal standards from guidelines. These procedures were carried out in professional laboratories affiliated with the hospitals. (20)

The extracted data included maternal age, gravidity, gestational age by trimesters, identified bacterial species, and antibiotic susceptibility patterns.

The data were encoded and analyzed using a computerized program of SPSS version 26. The descriptive statistics included frequency and percentage, which were summarized in a graphical and tabular manner, while inferential statistics such as the Chi-square test were used. A P-value of less than 0.05 was considered statistically significant.

Results

Out of 143 pregnant women diagnosed with urinary tract infection and assessed for bacterial profile and antimicrobial susceptibility outcomes at multicentric health sectors in Tripoli, Libya, over a six-month period from January to June 2025. In this study, the most frequent maternal age was 43.36% (62) between 17-25 years, followed by 32.16% (46) for ages ranging between 26-35 years, while 24.48% (35) were between 36-45 years. (Figure 1)

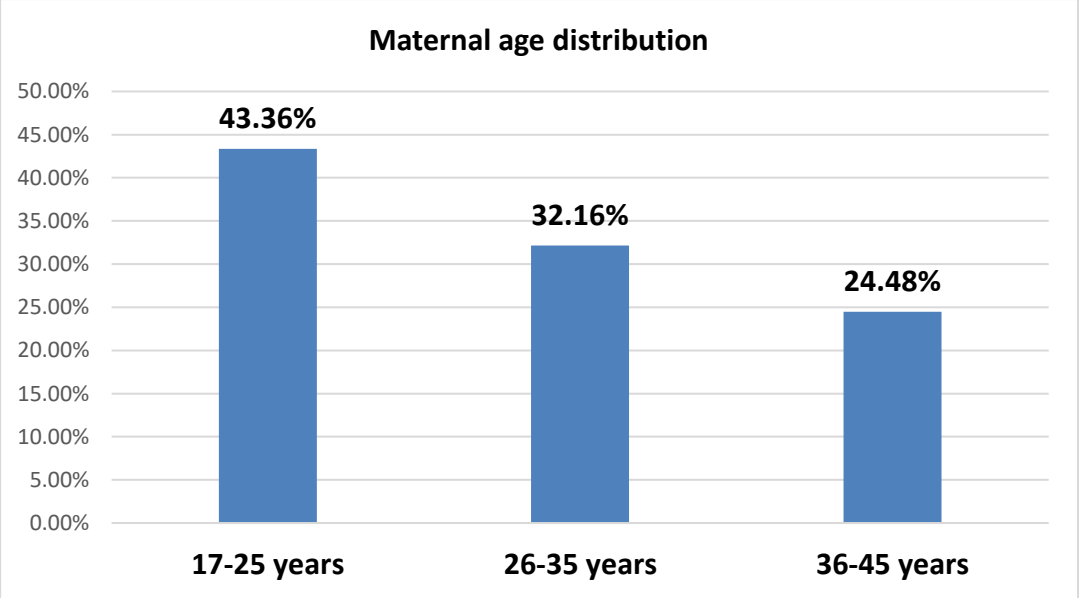

Figure 1: Maternal age distribution, Tripoli, Libya, 2025.

The majority of cases were multigravida accounted for 76.93% (110) while 23.07% (33) of them were primigravida. (Figure 2)

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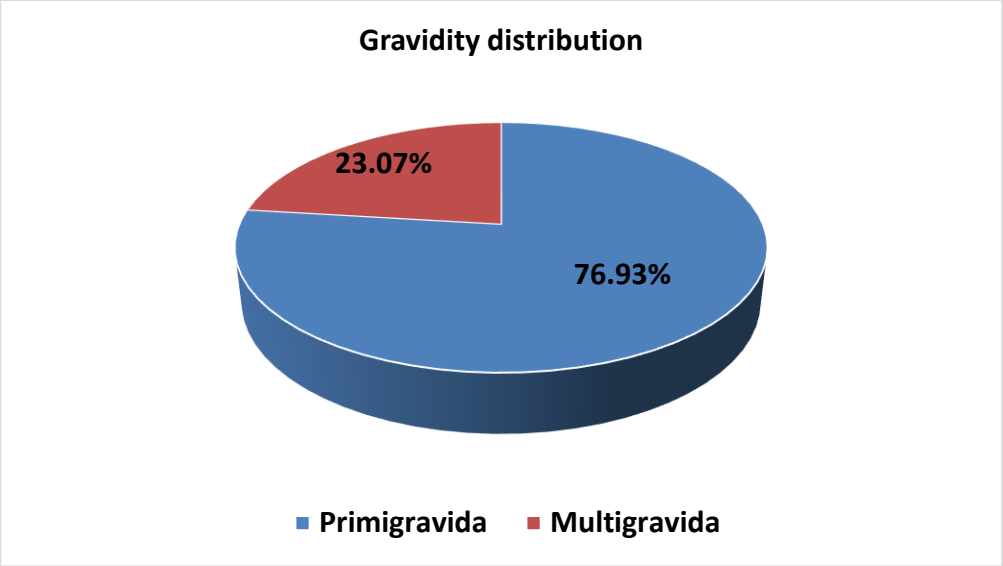

Figure 2: Gravidity distribution, Tripoli, Libya, 2025.

Most of cases were in the second trimester, accounting for 43.36% (62), while 32.86% (47) at first trimester and 23.78% (34) at third trimester. (Figure 3)

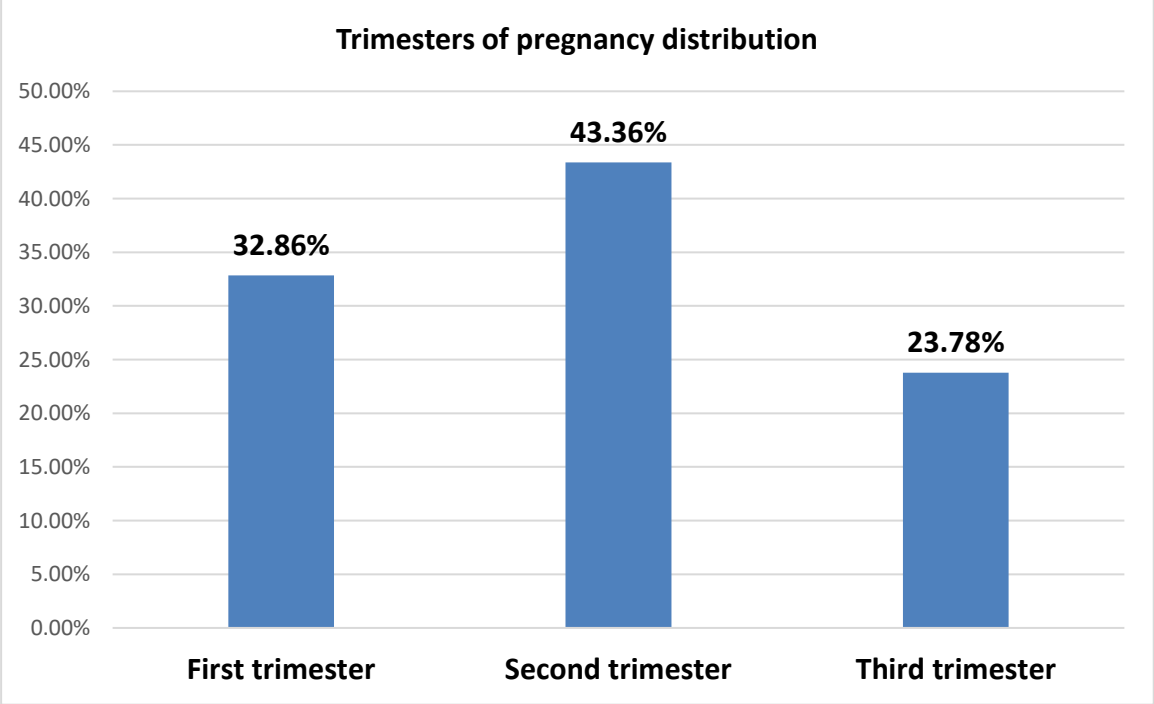

Figure 3: Trimesters of pregnancy distribution, Tripoli, Libya, 2025.

Regarding the bacterial identification by urine cultures, the most predominant uropathogens were *E. coli*, which accounted for 33.56% (48), followed by 18.18% (26) identified as *Klebsiella pneumoniae*. (Table 1)

Table 1: Bacterial identification by urine cultures distribution, Tripoli, Libya, 2025.

Variables (n = 143)	Frequency	Percentage
E. coli	48	33.56%
Klebsiella pneumonia	26	18.18%
Staphylococcus aureus	19	13.29%
Streptococcus agalactiae	9	6.29%
Enterobacter cloacae	5	3.50%
Citrobacter freundii	4	2.80%
Staphylococcus saprophyticus	3	2.10%

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Pseudomonas aeruginosa	2	1.40%
Bacillus subtillis	1	0.70%
Micrococcus luteus	1	0.70%
Proteus mirabilis	1	0.70%
No growth	22	15.38%
Normal flora	2	1.40%
Total	143	100%

Regarding the antimicrobial susceptibility outcomes, almost all uropathogens had good sensitivity for Gentamicin and imipenem, as well as some of them for ceftriaxone. Frequent antibiotic resistance to Nitrofurantoin, Amoxicillin, Amoxicillin/Clavulanic acid, and Ciprofloxacin was detected particularly among *E. coli* and *Klebsiella pneumoniae*. A statistically significant finding was detected with a P-value that was less than 0.001 (Table 2).

Table 2: Antimicrobial susceptibility outcomes distribution, Tripoli, Libya, 2025.

Variables (n = 143)	Amoxicillin	Amoxicillin /Clavulanic acid	Ceftriaxone	Ciprofloxacin	Imipenem	Gentamycin	Nitrofurantoin
E. coli	R	R	S	R	S	S	R
Klebsiella pneumonia	R	R	S	S	S	S	R
Staphylococcus aureus	S	S	R	R	S	S	S
Streptococcus agalactiae	S	S	S	R	R	S	S
Enterobacter cloacae	S	R	S	S	S	S	R
Citrobacter freundii	S	S	S	S	S	S	S
Staphylococcus saprophyticus	S	S	S	S	S	S	S
Pseudomonas aeruginosa	S	S	R	R	S	S	R
Bacillus subtillis	S	S	S	S	S	S	S
Micrococcus luteus	S	S	S	S	S	S	S
Proteus mirabilis	S	S	S	S	S	S	S

S = Sensitive, R = Resistance

Discussion

Urinary tract infection (UTI) is considered a common health concern among pregnant women. Multiple maternal and fetal complications have been recognized but can be prevented by timely detection and proper treatment (21-24). For these reasons, the present study evaluated 143 pregnant women who were diagnosed with urinary tract infection for bacterial profile and antimicrobial susceptibility outcomes in Tripoli, Libya during 2025.

Most of the presented cases were younger in age, ranging between 17–25 years, which is consistent with the Leppälahti S *et al* study that found Finnish teenagers had 2.9 times the risk of UTI. (25) This can be suggested as a result of inadequate perineal hygiene habits after urination, as mentioned in the Edae M *et al* study (26). In terms of uropathogen identification in the current study, E. coli was the most frequent uropathogen, which accounted for 33.56%. Our results are comparable to several studies with slightly higher percentage variations in Yemen (41.5 %), Nigeria (42.1 %), Sudan (42.4 %), and Ethiopia (44 .0%) (27–30). The second uropathogen in this study was Klebsiella pneumoniae, as reported in the literature. (31).

Additionally, these findings were comparable to a recent study in Libya by Elabbar F *et al* that reported *E. Coli* (43.0%), followed by *Klebsiella pneumoniae* (10.3%). But controversial results regarding nitrofurantoin and cephalosporin sensitivity were found to be resistant in our study. Moreover, the resistance of Nitrofurantoin was also reported in the Akoachere JF *et al* study, similar to our results. (32-33). This can be explained as a result of antibiotic overuse and abuse that contributed to a rise in the rate of multidrug resistance and the limitation of clinicians' choices to a few drugs for urinary tract infection.

The limitation of the study was a short time period, while the strength of the study was a multicentric approach.

Conclusion

In summary, the most frequent uropathogen among pregnant women was *E. coli* (33.56%) followed by *Klebsiella pneumoniae* (18.18%). The majority of uropathogens exhibited the highest sensitivity for Gentamicin, imipenem, and ceftriaxone, which suggested effective treatment outcomes when clinically indicated. Conversely, notable resistance patterns to commonly prescribed antibiotics such as nitrofurantoin, amoxicillin, Amoxicillin/Clavulanic acid, and Ciprofloxacin, reflecting the ongoing global concern regarding antibiotic misuse and the emergence of multidrug-resistant uropathogens. Several factors suggested to be implicated in this condition include younger age, Multigravidity, second

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trimester, and suspected overuse of antibiotics that leads to multidrug resistance. Therefore, early detection of urinary tract infection for high-risk cases is an essential approach to achieve optimal effective management outcomes and to reduce adverse perinatal outcomes.

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Ethical approval
Ethical approval was obtained from the selected hospital, and consent had been taken from patients who enter in the study.

Conflict of interest
This study declares that there is no conflict of interest in this study.

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