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Symptomatic and asymptomatic bacteriuria and antimicrobial susceptibility pattern among pregnant women in Kuwait

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ABSTRACT

During pregnancy, physiological changes predispose women to urinary tract infections. This study aimed to evaluate the prevalence of asymptomatic bacteriuria, antimicrobial susceptibility patterns, and associated risk factors among pregnant women. Three hundred urine samples were collected from pregnant women attending Professional We Care Poly Clinic, Sabah Al-Salem area, Kuwait, between January and December 2024. Samples were cultivated on cystine lactose electrolyte deficient agar (CLED) media. Bacterial isolates were identified and antimicrobial susceptibility determined using the automated Vitek2 system and disc diffusion method on Muller-Hinton agar. The infection rate among participants was 71.33% (95% Confidence Interval (CI): 68.18-73.12%), representing 214 of 300 women. Among those examined, asymptomatic bacteriuria was identified in 51.39% (95% CI: 49.27-53.15%), corresponding to 154 cases, while symptomatic bacteriuria was observed in 19.98% (95% CI: 16.18-22.11%) of all participants. The predominant isolate was *Escherichia coli* (34.58%), followed by Candida sp. (17.76%), *Streptococcus agalactiae* (15.89%), *Klebsiella pneumoniae* (12.62%), and *Enterococcus faecalis* (11.21%). Gram-negative bacteria exhibited high resistance rates to tetracycline (96.4%) and ampicillin (90.5%). Multidrug-resistant (MDR) bacterial isolates were prevalent in 83.9% (94/112) of Gram-negative bacteria and 37.5% (42/64) of Gram-positive bacteria. Extended-spectrum beta-lactamase (ESβL) production was observed in 8.9% of Gram-negative isolates. A significant presence of bacteriuria exists in asymptomatic pregnant women, with considerable antimicrobial resistance to commonly prescribed agents. Routine screening and antimicrobial susceptibility testing are recommended for appropriate management of bacteriuria during pregnancy.
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Introduction

Urinary tract infections (UTIs), encompassing infections of the urethra, bladder, or kidneys, affect approximately 400 million individuals annually, resulting in significant healthcare expenditures amounting to billions of dollars. The predominant bacterium associated with UTIs is uropathogenic *Escherichia coli*; however, a variety of other pathogens, including *Klebsiella pneumoniae*, *Enterococcus faecalis*, *Pseudomonas* sp., *Staphylococcus* sp., and fungi such as *Candida* species, can also cause these infections (Timm et al. 2024). UTIs can manifest in both genders and in individuals with varying health statuses, including those who are immunocompromised. Certain risk factors, such as being female, having a history of previous UTIs, or possessing a urinary catheter or other abnormalities in the urinary tract, increase susceptibility to these infections (Flores-Mireles et al. 2015). Asymptomatic bacteriuria (ASB) is characterized by the detection of 10^5 or more colony-forming units (CFU) per milliliter (mL) of urine, occurring without the presence of specific symptoms indicative of acute urinary tract infections (UTIs) (Maternal, 2017). Pregnant women face a heightened risk of asymptomatic bacteriuria, attributed to various mechanical factors, hormonal fluctuations, urinary stasis, and the reflux of urine from the bladder into the ureters (Abu et al. 2021). Consequently, it is essential to screen for bacteriuria during pregnancy, regardless of whether the patient exhibits symptoms, as early intervention can avert potential complications (Mwei et al. 2018). Both Gram-negative and Gram-positive bacteria are primarily responsible for asymptomatic bacteriuria (ASB) during pregnancy (Timm et al. 2024). The practice of screening for ASB has become a standard component of obstetric care, with most antenatal guidelines now recommending routine screening. The United States Preventive Services Task Force strongly advocates for both screening and treatment, a stance echoed in guidelines from various organizations, including the Infectious Diseases Society of America, the National Institute for Clinical Excellence, the European Association of Urology, the Canadian Task Force on Preventive Care, and the Scottish Intercollegiate Guidelines Network. Despite the recommendations in Ethiopia's Standard Treatment Guidelines for the screening and treatment of ASB, such practices have not been routinely implemented in antenatal care (Naber et al., 2001; Nicolle et al., 2005).

The prevailing clinical approach to managing UTIs relies heavily on antibiotic therapy. Unfortunately, the effectiveness of this strategy is diminishing due to the rising rates of antimicrobial resistance among UTI pathogens. This is compounded by the extensive use of antibiotics for these infections, which fosters the development of resistant strains (Timm et al. 2025). The increasing prevalence of antibiotic resistance among uropathogenic bacteria poses significant challenges to patient outcomes and extends the duration of hospitalizations. As a result, there is an urgent need for innovative approaches to mitigate and manage the proliferation of antibiotic resistance in these pathogens (Simoni et al. 2024). Over the last twenty years, substantial clinical initiatives and research developments have transformed the treatment and prevention strategies for urinary tract infections (UTIs), emphasizing the importance of judicious antibiotic use (Timm et al. 2025). The rise of antimicrobial stewardship programs, guidelines from national organizations, and the introduction of novel antimicrobials have significantly influenced contemporary UTI management. Looking ahead, the future of UTI treatment may be shaped by the continued advancement of antimicrobial stewardship, the availability of enhanced diagnostic tools, and a deeper comprehension of the microbiome's role in urinary tract infections (Price et al. 2024). Emerging strategies for the treatment and prevention of urinary tract infections (UTIs) may incorporate innovative bactericidal agents, synergistic combinations of both novel and traditional antimicrobials that improve bacterial eradication, therapeutic agents designed to inhibit bacterial adhesion to uroepithelial cells, the repurposing of existing medications, and the development of vaccines. These approaches aim to address the increasing prevalence of antibiotic resistance in uropathogenic bacteria and to enhance clinical outcomes for individuals suffering from UTIs (Flores-Mireles et al. 2015). Therefore, this study was conducted to evaluate the prevalence of asymptomatic and symptomatic bacteriuria, the antimicrobial susceptibility patterns of the bacterial isolates, and the associated risk factors among pregnant women at Professional We Care Poly Clinic, Sabah Al-Salem area, Mubarak Al-Kabeer Governorate, Kuwait.

Materials and Methods

This research was carried out at Outpatient Clinics for Obstetrics and Gynaecology, (Professional We Care Poly Clinic), Sabah Al-Salem area, Mubarak Al-Kabeer Governorate, Kuwait, between January and December 2024. The study included all pregnant women who visited the antenatal care services at Professional We Care Poly Clinic and did not exhibit any signs or symptoms of urinary tract infections (UTIs).

Study Design
A facility-based cross-sectional study was conducted among pregnant women receiving antenatal care at Professional We Care Poly Clinic, Sabah Al-Salem area, Mubarak Al-Kabeer Governorate, Kuwait. The study evaluated the prevalence of asymptomatic and symptomatic bacteriuria among participants.

Study Population and Eligibility Criteria
The study population comprised all pregnant women seeking antenatal care services at the clinic during the study period. Women who consented to participate and provided urine samples were included, regardless of the presence or absence of UTI symptoms. Pregnant women who had received antibiotic treatment within the previous two weeks and those who were critically ill and unable to complete the questionnaire were excluded from the study.

Isolation, identification, and antimicrobial susceptibility testing
Following acquisition of written informed consent, approximately 5 mL of freshly voided midstream urine samples were collected in sterile, wide-mouth containers with screw caps. Participants were instructed to wash their hands, cleanse the genital area with clean water, and collect the midstream urine into the designated container. Urine specimens were immediately inoculated onto cystine lactose electrolyte deficient agar (CLED) (Oxoid, Ltd., England) using the streak plate method with a calibrated inoculating wire loop (0.001 mL). Culture plates were incubated at 37°C for 24-48 hours, after which they were examined for pathogen growth. Plates exhibiting $\geq 10^5$ bacterial colonies per mL of urine were subsequently sub-cultured onto MacConkey agar (Oxoid, England) and 5% sheep blood agar (Oxoid, England) for further identification. Bacterial isolates were subjected to identification and antibiotic susceptibility testing utilizing the automated Vitek2 system (GN and GP identification cards, Version 05.04, BioMerieux SA, France) to ensure precise identification and assessment of their susceptibility to antibiotics (Basha et al. 2020).

Phenotypic detection of bacterial strains producing extended-spectrum beta-lactamase (ESBL)
Screening for potential ESBL-producing bacterial isolates was conducted utilizing Ceftazidime disc (30μg) and/or Cefotaxime disc (30μg). An inhibition zone of ≤ 22mm with Ceftazidime (30μg) and/or ≤ 27mm with Cefotaxime (30μg) indicated a possible ESBL producer. Such isolates were then chosen for confirmation via the combination disk test (CDT), following the recommendations set forth by the Clinical and Laboratory Standards Institute (CLSI, 2023). The detection of extended spectrum β-lactamases was carried out through a combined disc test methodology as descried by Fareid et al. (2025). Discs of Ceftazidime (30μg), Cefotaxime (30μg), Ceftazidime with Clavulanic acid (30μg/10μg), and Cefotaxime with Clavulanic acid (30μg/10μg) were arranged 15mm apart on a Muller-Hinton Agar (MHA) plate (HiMedia Laboratories Pvt. Ltd., Thane, India). A bacterial suspension corresponding to the 0.5 McFarland turbidity standard was inoculated and incubated at 37˚C for 18 to 24 hours. A notable increase in the inhibition zone diameter of ≥5 mm for the combination disc compared to the individual ceftazidime or cefotaxime discs was indicative of ESBL production.

Data Quality Assurance Measures
A comprehensive quality assurance protocol was implemented to ensure the integrity of the data. Data collectors received training aimed at reducing technical errors and preserving data quality. At the conclusion of each data collection day, the gathered data were reviewed for completeness. Standard operating procedures (SOPs) were meticulously adhered to throughout all laboratory processes, including sample collection, inoculation, culturing, biochemical testing, and antimicrobial susceptibility assessments. The sterility and efficacy of the culture media were verified. Quality control parameters during culture and antimicrobial susceptibility testing included the use of American Type Culture Collection (ATCC) reference strains such as *Escherichia coli* ATCC® 25922, and *Staphylococcus aureus* ATCC® 25923. All standard strains were obtained from bacteriology lab. Botany and Microbiology Department, Faculty Science, Al-Azhar University.

Data processing and analysis
Data processing and analysis involved the initial entry and cleaning of data using Epi-data version 3.1, followed by exportation to GraphPad Prism Software version 8.0 (GraphPad Software, Inc., La Jolla, CA, USA) for statistical analysis. Microbiological experiments were conducted in triplicate, and results are presented as mean ± standard deviation. A two-way ANOVA was employed to compare experimental and control groups, with statistical significance set at $p<0.05$. Confidence intervals were calculated using the Wilson score method in GraphPad Prism.

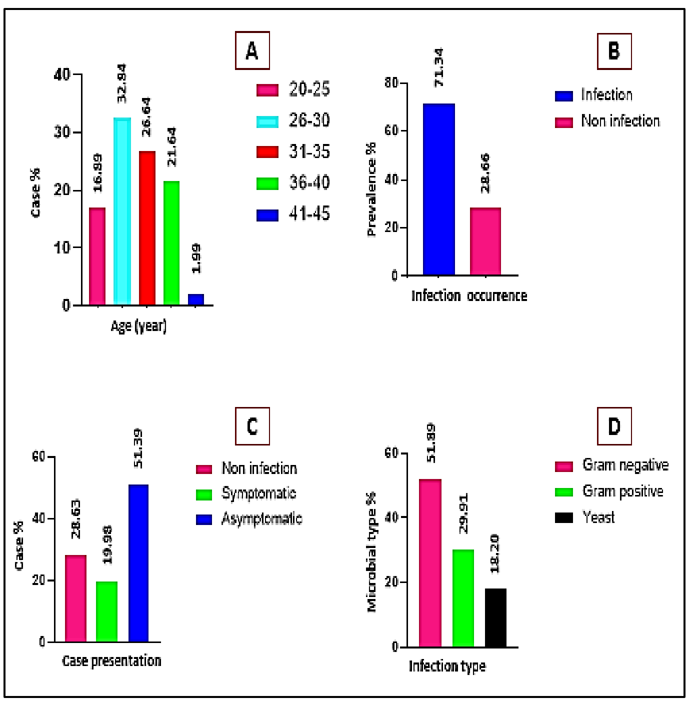
Ethical approval
The research received ethical approval from the Ethical Review Board (ERB) of the Ministry of Health, Kuwait

(2024-2548). During data collection, each participant was informed about the study's objectives, and written informed consent was secured. All participant information was treated with strict confidentiality, and specimens were analyzed solely for specified research purposes. Pregnant women identified with significant bacteriuria were provided with appropriate treatment according to national guidelines.

Results and Discussion

Demographic Characteristics and Bacteriuria Prevalence

The study included 300 pregnant women across all three trimesters who received care at Professional We Care Poly Clinic, Sabah Al-Salem area, Kuwait. The age distribution of participants was as follows: 16.89% were 20-25 years, 32.63% were 26-30 years, 26.64% were 30-35 years, 21.64% were 36-40 years, and 1.99% were 41-45 years. The overall infection rate among participants was 71.33% (95% CI: 68.18-73.12%), with 214 out of 300 women affected (Initial screening of samples on CLED agar identified 214 samples with significant bacterial growth (≥10^5 CFU/mL), which were then subcultured onto MacConkey and blood agar for further identification). Among the total cohort, asymptomatic bacteriuria was observed in 51.39% (95% CI: 49.27-53.15%), corresponding to 154 cases, while symptomatic bacteriuria was present in 19.98% (95% CI: 16.18-22.11%), accounting for 60 out of 300 cases, as illustrated in Fig. 1A, 1B and 1C. Asymptomatic bacteriuria is frequently observed in various populations, encompassing healthy women as well as individuals with pre-existing urologic conditions (Abde et al. 2015). A previous study conducted in Benin City, Nigeria, revealed a notable prevalence of asymptomatic bacteriuria, with a total of 556 cases representing 45.3% of the study population (Imade et al. 2010). Sonkar et al. 2021), reported that 36 out of 216 pregnant women (16.7%) exhibited asymptomatic bacteriuria. Generally, the prevalence of asymptomatic bacteriuria among pregnant women ranges from 2% to 15% globally. Approximately 80% of urinary tract infections (UTIs), whether asymptomatic or symptomatic, are attributed to *Escherichia coli*, with Group B *Streptococci* (GBS) being the second most common pathogen associated with UTIs in pregnant individuals (Nicolle et al. 2019). Asymptomatic bacteriuria prevalence increases with age, starting at less than 2% in children and rising to as high as 50% among elderly individuals residing in long-term care facilities (Wiley et al. 2020). The difference observed in the rates of asymptomatic bacteriuria may be attributed to reduced immunity during pregnancy or the anatomical proximity of the female urethra to the anal region. Additionally, challenges faced during pregnancy in maintaining hygiene after defecation could lead to contamination of the urinary tract with fecal bacteria, enhancing growth of pathogens, predominantly Gram-negative organisms (Abu et al. 2021). In our study, there was significant variation in the prevalence of asymptomatic bacteriuria across trimesters. A previous investigation revealed that out of three women identified with ASB in the first trimester, two (67%) also presented with ASB during the second trimester (Sheppard et al. 2023). Gram-negative bacteria, 51.87% (95% CI: 48.21–55.3%) were more prevalent than Gram-positive bacteria and yeast as shown in Fig. 1D. Research conducted in different geographical locations has revealed a considerable prevalence of Gram-negative bacteria, with percentages recorded at 64.7% in Adigrat, Northern Ethiopia (Wiley et al. 2020), 64.1% in Nairobi, Kenya (Adelaide et al. 2017), 69.6% in the central region of Iran (Aliasghar et al. 2018), and 62.3% in Bengal, India (Kheya et al. 2014), Conversely, other studies conducted in Dessie, Northeast Ethiopia, and Hawassa, Southern Ethiopia, reported a predominance of Gram-positive bacteria (Tadesse et al. 2014; Ali et al. 2018). These observed discrepancies may be explained by variations in environmental factors such as temperature and humidity, as well as differences in the levels of antimicrobial usage among patients in these regions, which could influence bacterial distribution (Wiley et al. 2020). *Escherichia coli* was identified as the most prevalent bacterial isolate in asymptomatic bacteriuria cases in this study, accounting for 31.1%, followed by *Candida* sp. (19.4%), *Streptococcus agalactiae* (15.5%), and *K. pneumoniae* (14.27%). In symptomatic cases, *E. coli* constituted 43.3%, followed by *Streptococcus agalactiae* (16.6%), *Candida* sp. (13.3%), and *K. pneumoniae* (8.3%), as shown in Fig 2. Our findings reveal a significant presence of *E. coli*, which is in agreement with studies from Bahir Dar, Northwest Ethiopia (Demilie et al. 2012), Hawassa, Southern Ethiopia (Jyoti et al. 2017)., Egypt (Elzayat et al. 2017) and India Tadesse et al. 2014) and Ghana (Turpin et al. 2007). The ability of *E. coli* to produce various virulence factors that promote its colonization and invasion of the urinary epithelium likely contributes to its prevalence among pregnant women with asymptomatic bacteriuria (Lavigne et al. 2011). A previous study carried out in Saudi Arabia with 321 pregnant women determined the distribution of bacteria causing UTIs as follows: *Escherichia coli* (57.01%), *Klebsiella pneumoniae* (24.61%), *Pseudomonas aeruginosa* (4.36%), *Proteus mirabilis* and *Enterobacter cloacae* (each 3.74%), *Streptococcus agalactiae* (3.11%), *Enterococcus faecalis* (2.18%), and *Staphylococcus aureus* (1.24%) (Al-Shahrani et al. 2024). *Escherichia coli* is identified as the most prevalent organism responsible for 75-90% of bacteriuria observed in pregnancy. Other microbial contributors include *Proteus mirabilis*, group B *Streptococcus, Pseudomonas aeruginosa*, *Klebsiella pneumoniae, Streptococcus saprophyticus, Staphylococcus aureus, and Enterococcus faecalis* (Awoke et al. 2021). Several studies concerning asymptomatic bacteriuria during pregnancy have identified *E. coli* as the most frequently detected pathogen in screening assessments. *E. coli* can easily colonize and infiltrate the urinary tract endothelium. For instance, research indicates that *E. coli* strains isolated from pregnant women with ASB in France exhibit a virulence potential comparable to that of *E. coli* strains from cystitis cases (Garnizov, 2015). Untreated asymptomatic bacteriuria carries a 20-30% likelihood of progressing to pyelonephritis during later stages of pregnancy. More than 40% of sexually active young women harbor *S. saprophyticus* in the rectum, urethra, or cervix at any point in time (Kauffman et al. 1983).



. **Fig 1.** (A) age distribution, (B) infection percentage, (C) symptomatic and asymptomatic, (D) type microbial infection of pregnant women screened.

Antimicrobial Susceptibility Patterns

The antimicrobial susceptibility profile revealed that bacterial uropathogens isolated from pregnant women with both symptomatic and asymptomatic UTIs exhibited high-frequency resistance to several tested antimicrobial agents. A significant majority of the Gram-negative bacterial isolates demonstrated high

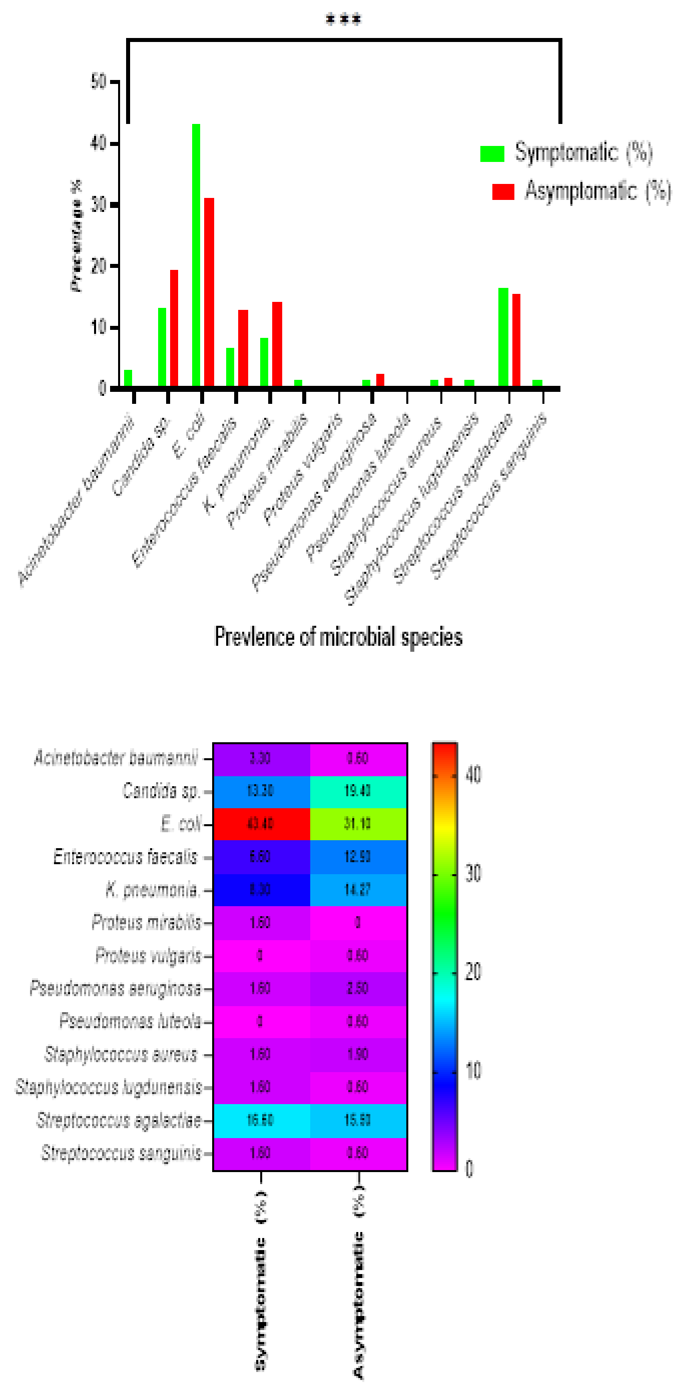


Fig 2. Prevalence of bacterial species isolated from urine of pregnant women with symptomatic and asymptomatic bacteriuria.

resistance to clindamycin (75.1%), cephalexin (66.6%), trimethoprim/sulfamethoxazole (66.5%), and ceftazidime (63.3%). Conversely, these isolates were largely sensitive to imipenem, meropenem, and levofloxacin, with sensitivity rates of 81.8%, 78.4%, and 75.7%, respectively, as illustrated in fig 3A and

Table 1. These results are consistent with findings from studies conducted in Khartoum**,** Sudan (El-Arifi et al. 2024), Addis Ababa, Ethiopia (Bizuwor et al. 2021), Baghdad Iraq (Ali et al. 2016), and Kanpur, India (Ujatha al. 2014). The widespread availability of commonly prescribed antimicrobials without a prescription, coupled with the inappropriate use of antibiotics by both patients and healthcare providers, the shortage of trained personnel for urine culture, and the frequent use of standard antimicrobial agents without medical oversight may contribute to the elevated rates of antimicrobial resistance observed (El-Sherbiny et al. 2024a; (El-Sherbiny et al. 2024b). A previous investigation revealed that Gram-negative bacterial isolates were obtained from asymptomatic pregnant woman who exhibited resistance to commonly used antibiotics. *Escherichia coli*, identified as the most commonly isolated organism, demonstrated sensitivity to gentamicin and imipenem (Nteziyaremye et al. 2020). The Gram-positive bacterial isolates from symptomatic and asymptomatic UTIs showed significant resistance to erythromycin, clindamycin, gentamicin, and cephalexin, with resistance percentages of 92.04%, 84.24%, 79.56%, and 76.44%, respectively. Conversely, all Gram-positive isolates were highly sensitive to levofloxacin, cefuroxime, ceftriaxone, and vancomycin (84.3%, 81.2%, 81.2%, and 79.7%, respectively), as illustrated in fig 3B and Table 2. Abu and his colleagues demonstrated that Gram-positive bacterial strains obtained from cases of asymptomatic bacteriuria exhibited a high level of resistance to tetracycline (100%), trimethoprim-sulfamethoxazole (81.8%), penicillin (72.72%), and nalidixic acid (54.5%) (Abu et al. 2021). Nteziyaremye and his collage showed that the Gram-positive isolates from asymptomatic pregnant woman exhibited resistance to frequently utilized antibiotics, including amoxicillin combined with clavulanic acid, sulfamethoxazole in conjunction with trimethoprim, erythromycin, and penicillin (Nteziyaremye et al. 2020). In this study, *E. coli* exhibited significant resistance to clindamycin and sulfamethoxazole-trimethoprim, with resistance rates of 74.3% and 67.5%, respectively. Meanwhile, *K. pneumonia* displayed significant resistance to cefotaxime and ceftazidime, achieving a resistance rate of 66.6%. In addition, *P. aeruginosa* showed a resistance rate of 100% to both cephalexin and sulfamethoxazole-trimethoprim. Similarly, *A. baumannii* displayed complete resistance to piperacillin/tazobactam, ceftriaxone, cefotaxime, clindamycin, and cefixime, with resistance rates also at 100%. Furthermore, *Proteus mirabilis* demonstrates resistance to most antibiotics that have been tested, with the exceptions of amikacin, piperacillin/tazobactam, and ceftazidime as shown in fig 4A and Table 1. These findings are consistent with research conducted in Uganda (Andabati and Byamugisha, 2010) and various other locations, which identified *E. coli* as the predominant organism isolated. *E. coli* is frequently found in the perineal region, and inadequate personal hygiene practices may elevate the risk of infection with this microorganism (Ali et al., 2018; Nteziyaremye et al., 2020). Several studies have revealed that Gram-negative isolates show resistance to widely used antibiotics (Teklu et al., 2019; Nteziyaremye et al., 2020; Abu et al., 2021). In our study, *Streptococcus agalactiae* demonstrates a resistance rate of 91.1% to both erythromycin and clindamycin. In contrast, *Enterococcus faecalis* shows complete resistance to erythromycin and a resistance rate of 91.6% to cephalexin. Overall, *Staphylococcus aureus* exhibited complete resistance to both amoxicillin/clavulanate and clindamycin, with a resistance rate of 100% as illustrated in fig 4B and Table 2. Similarly, other studies have found that Gram-positive bacterial isolates from asymptomatic UTIs were resistant to several commonly prescribed antibiotics, such as amoxicillin-clavulanic acid, sulfamethoxazole-trimethoprim, erythromycin, and penicillin (Ayoyi et al. 2019). However, *Staphylococcus aureus* showed sensitivity to imipenem and gentamicin. The resistance to these widely used antibiotics could potentially stem from their overuse or misuse (Nteziyaremye et al. 2020). The prevalence of multidrug-resistant (MDR) bacterial isolates is 83.9% (94 out of 112) for Gram-negative bacteria, whereas it is 37.5% (42 out of 64) for Gram-positive bacteria. Additionally, the production of extended-spectrum beta-lactamases (ESβL) by Gram-negative bacterial isolates is observed at a rate of 8.9%, as illustrated in Fig 5 and 6. Nteziyaremye and his colleagues (2020), reported that all isolates obtained from asymptomatic pregnant women exhibited a significant level of multidrug resistance (MDR). This finding consistent with previous studies conducted in Uganda, and Nepal (Najjuka et al. 2016; Stanley et al. 2018) A previous investigation revealed that multidrug resistance (MDR) was present in 74.4% of the isolated bacterial uropathogens (Abu et al. 2021). Additionally, Tikur Anbessa Specialized Hospital in Addis Ababa reported a MDR rate of 74% (Ali et al. 2018). The bacterial strains identified in this research included expanded spectrum beta-lactam (ESβL) producing organisms among the gram-negative isolates. The rise of MDR has been linked to the extensive use of antibiotics, inappropriate medication practices, and insufficient antibiotic monitoring, which together contribute to the selection of antibiotic

resistance mechanisms in bacteria. The emergence of MDR isolates poses a serious challenge, undermining the efficacy of broad-spectrum antibiotics and significantly affecting patient outcomes (El-Sherbiny et al. 2024; Foda et al. 2024).

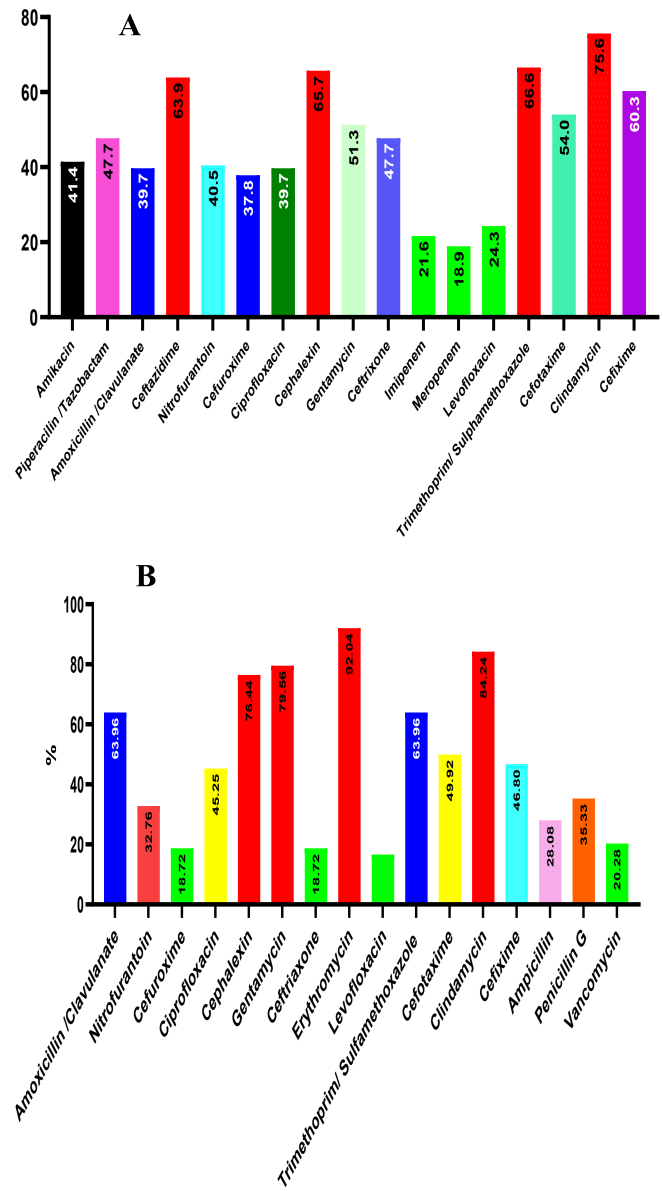


Fig 3. Resistance patterns of bacterial isolates: (A) Gram-negative and (B) Gram-positive bacteria isolated from pregnant women with symptomatic and asymptomatic bacteriuria.

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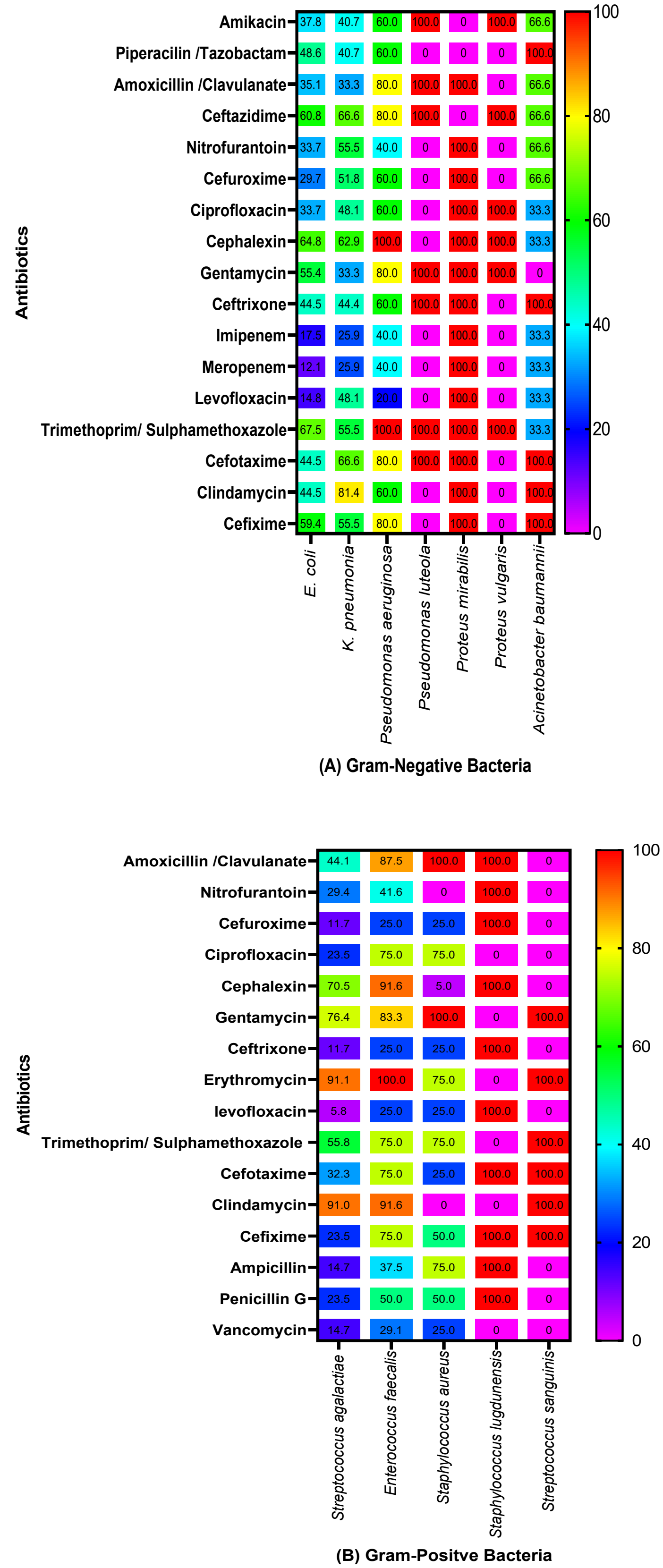

Fig 4. Antibiotic susceptibility pattern (A) Gram-negative and (B) Gram- positive bacteria

Table 1. Antimicrobial susceptibility pattern of Gram-negative bacteria isolated from pregnant women with symptomatic and asymptomatic UTI.

Bacterial isolates (no)		Antimicrobial agents assessed																
		AMK	PPT	Am-c	CAZ	NIT	CTX	CIP	CEX	GEN	CEF	IMI	MER	LEV	SMT	CTX	CL	CFM
E. coli n=74	S (%)	46 (62.1)	38(51.3)	48(64.8)	29(39.1)	49(66.2)	52(70.2)	49(66.2)	26(34.2)	33(43.4)	41(55.4)	61(82.4)	65(87.8	63(85.1)	24(32.4)	41(55)	19(25.7)	30(40.5)
	R (%)	28 (39.9)	36(48.63	26(35.1)	45(60.8)	25(33.7)	22(29.7)	25(33.7)	48(64.8)	41(55.4)	33(44.5)	13(17.5)	9(12.1)	11(14.8)	50(67.5)	33(44.5)	55(74.3)	44(59.4)
K. pneumonia n=27	S (%)	16 (59.2)	16(59.2)	18(66.6)	9 (33.3)	12(44.4)	13(48.1)	14(51.8)	10(37.1)	18(66.6)	15(55.5)	20 (70)	20 (70)	14(48.1)	12(44.4)	9 (33.3)	5 (18.5)	12(44.4)
	R (%)	11(40.2)	11(40.2)	9(33.3)	18(66.6)	15(55.5)	14(51.8)	13(48.1)	17(62.9)	9 (33.3)	12(44.4)	7(25.9)	7(25.9)	13(48.1)	15(55.5)	18(66.6)	22(81.4)	15(55.5)
P. aeruginosa n=5	S (%)	2 (40.0)	2 (4.00)	1 (20.0)	1 (20.0)	3 (60.0)	2 (40.0)	2 (40.0)	0 (0.0)	1(20.0)	2 (40.0)	3 (60.0)	3 (60.0)	4(80.0)	0 (0.0)	1 (20.0)	2 (40.0)	1 (20.0)
	R (%)	3(60.0)	3(60.0)	4(80)	4(80.0)	2(40.0)	3(60.0)	3(60.0)	5(100)	4(80.0)	3(60.0)	2 (40.0)	2 (40.0)	1(20.0)	5(100)	4(80.0)	3 (60.0)	4(80)
P. luteola n=1	S (%)	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)	1 (100)	1 (100)	1 (100)	1 (100)	0 (0.0)	0 (0.0)	1 (100)	1 (100)	1 (100)	0 (0.0)	0 (0.0)	1 (100)	1 (100)
	R (%)	1 (100)	0 (0.0)	1 (100)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100)	1 (100)	0 (0.0)	0 (0.0)
Proteus mirabilis n=1	S (%)	1 (100)	1 (100)	0(0.0)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	R (%)	0 (0.0)	0 (0.0)	1 (0.0)	0(0.0)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)
Proteus vulgaris n=1	S (%)	0 (0.0)	1 (100)	1 (100)	0 (0.0)	1 (100)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100)	1 (100)	1 (100)	1 (100)	0 (0.0)	1 (100)	1 (100)	1 (100)
	R (%)	1 (100)	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)	1 (100)	1 (100)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)
A. baumannii n=3	S (%)	1 (33.3)	0 (0.0)	1 (33.3)	1 (33.3)	1 (33.3)	1 (33.3)	2 (66.6)	2 (66.6)	3 (100)	0 (0.0)	2 (66.6)	2 (66.6)	2 (66.6)	2 (66.6)	0 (0.0)	0 (0.0)	0 (0.0)
	R (%)	2(66.66)	3 (100)	2(66.66)	2(66.66)	2(66.66)	2(66.66	1 (33.3)	1 (33.3)	0 (0.0)	3 (100)	1 (33.3)	1 (33.3)	1 (33.3)	1 (33.3)	3 (100)	3 (100)	3 (100)
Total n=112	S (%)	66(58.3)	59(52.6)	69(615)	41(36.5)	67(59.8)	70(62.4)	68(60.7)	39(34.8)	55(49.2)	59(52.)	88(78.5)	92(82.)	85(75.8)	38(33.9)	52(46.4)	28(25.0)	45(40.1)
	R (%)	47(41.6)	53(47;3)	43(38/3)	71(63.3)	45(40.1)	42(37.5)	44(39.2)	73(65.1)	57(50.8)	53(47.3)	24(21.4)	20(17.)	27(24.2)	74(66.0)	60(53.5)	84(75.0)	67(59.8)

Where: S susceptible; R resistant; AMK amikacin, PPT Piperacillin /Tazobactam, Amx-c amoxicillin clavulanic acid; CAZ ceftazidime, NIT Nitrofurantoin, CFX Cefotaxime, CIP ciprofloxacin, CEX Cephalexin, GEN gentamycin, CEF ceftriaxone, IMI imipenem, MER meropenem, LEV levofloxacin, SMT sulfamethoxazole-trimethoprim, CTX - Cefotaxime, CL Clindamycin, CFM Cefixime

Table 2. Antimicrobial susceptibility pattern of Gram-positive bacteria isolated from pregnant women with symptomatic and asymptomatic UTI.

Antimicrobial agents tested	*Streptococcus agalactiae* n=34		*Enterococcus faecalis* n=24		*Staphylococcus aureus* n=4		*Staphylococcus lugdunensis* n=1		*Streptococcus sanguinis* n=1		Total n = 64	
	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)
Amoxicillin /Clavulanate	19 (55.8)	15(44.1)	3 (12.5)	21(87.5)	0 (0.0)	4(100)	0 (0.0)	1(100)	1 (100)	0(0.0)	23(35.9)	41(64.1)
Nitrofurantoin	24 (70.5)	10(29.4)	14 (58.3)	10(41.6)	4 (100)	0(0.0)	0 (0.0)	1(100)	1 (100)	0(0.0)	43(67.2)	21(32.8)
Cefuroxime	30 (88.2)	4(11.7)	18 (75)	6(25)	3 (75)	1(25)	0 (0.0)	1(100)	1 (100)	0(0.0)	52(81.2)	12(18.8)
Ciprofloxacin	26 (76.4)	8(23.5)	6 (25)	18(75)	1 (25)	3(75)	1 (100)	0(0.0)	1 (100)	0(0.0)	35(54.7)	29(45.3)
Cephalexin	10 (29.4)	24(70.5)	2 (8.3)	22(91.6)	2 (50)	2(50)	0 (0.0)	1(100)	1 (100)	0(0.0)	15(23.4)	49(76.6)
Gentamycin	8 (23.5)	26(76.4)	4 (16.6)	20(83.3)	0 (0.0)	4(100)	1 (100)	0(0.0)	0(0.0)	1(100)	13(20.3)	51(79.7)
Ceftriaxone	30 (88.2)	4(11.7)	18 (75)	6(25)	3 (75)	1(25)	1 (100)	1(100)	1 (100)	0(0.0)	52(81.2)	12(18.8)
Erythromycin	3 (8.8)	31(91.1)	0 (0.0)	24(100)	1 (25)	3(75)	1 (100)	0(0.0)	1 (100)	0(0.0)	6(9.4)	58(90.6)
levofloxacin	32 (94.1)	2(5.8)	18 (75)	6(25)	3 (75)	1(25)	0 (0.0)	1(100)	1 (100)	0(0.0)	54(84.3)	10(15.7)
Trimethoprim/ Sulfamethoxazole	15 (44.1)	19(55.8)	6 (25)	18(75)	1 (25)	3(75)	1 (100)	0(0.0)	0 (0.0)	1(100)	23(35.9)	41(64.1)
Cefotaxime	23 (67.6)	11(32.3)	6 (25)	18(75)	3 (75)	1(25)	0 (0.0)	1(100)	0 (0.0)	1(100)	32(50.0)	32(50.0)
Clindamycin	3 (8.8)	31(91.1)	2 (8.3)	22(91.6)	2 (50)	2(50)	1 (100)	0(0.0)	0 (0.0)	1(100)	8(12.5)	56(87.5)
Cefixime	26 (76.4)	8(23.5)	6 (25)	18(75)	2 (50)	2(50)	0 (0.0)	1(100)	0 (0.0)	1(100)	34(53.1)	30(46.9)
Ampicillin	29 (85.2)	5(14.7)	15 (62.5)	9(37.5)	1 (25)	3(75)	0 (0.0)	1(100)	1 (100)	0(0.0)	46(71.9)	18 (29.1)
Penicillin G	26 (76.4)	8(23.5)	12 (50)	12(50)	2 (50)	2(50)	0 (0.0)	1(100)	1 (100)	0(0.0)	41(64.1)	23(35.9)
Vancomycin	29 (85.2)	5(14.7)	17 (70)	7(29.1)	3 (75)	1(25)	1 (100)	0(0.0)	1 (100)	0(0.0)	51(79.7)	13(20.3)

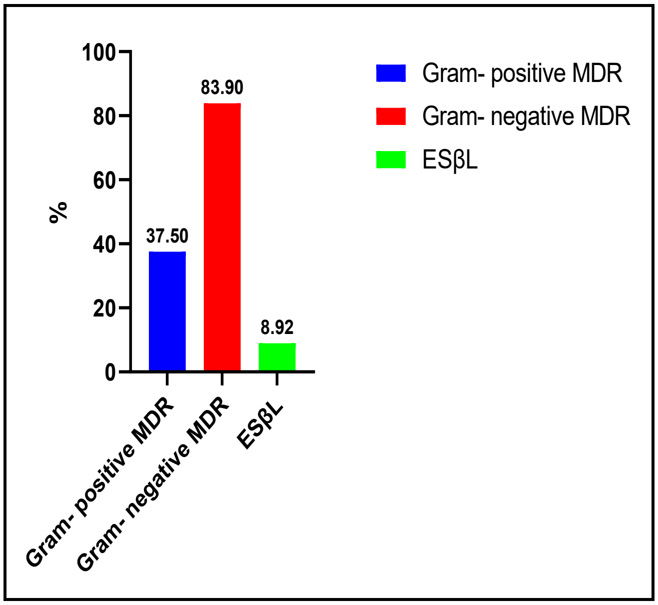

Fig 5. Frequency of multidrug resistant (MDR) and extended-spectrum β-lactamases

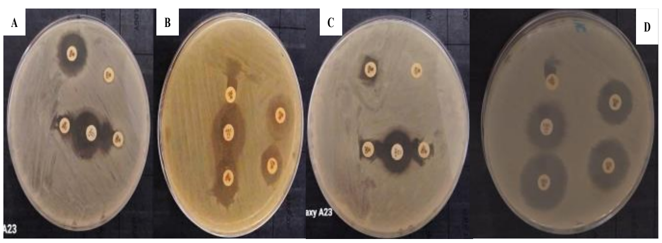

Fig 6. Extended-spectrum β-lactamases (ESβLs**)** (A, B, and C positive and D negative).

Conclusion

A significant proportion of pregnant women without symptomatic UTIs were found to have asymptomatic bacteriuria. The most common bacterial isolates were *E. coli*, followed by *Streptococcus agalactiae* and *K. pneumoniae*. A considerable percentage of these bacterial isolates exhibited resistance to commonly used antimicrobial medications. This research highlighted a notable prevalence of multidrug-resistant bacterial isolates among pregnant women with asymptomatic bacteriuria in Kuwait. These findings emphasize the importance of routine screening for asymptomatic bacteriuria in pregnant women to prevent potential complications. Furthermore, the high rates of antimicrobial resistance observed underscore the need for antimicrobial stewardship programs and judicious use of antibiotics in this vulnerable population. It is crucial to perform urine culture and antimicrobial susceptibility testing for women diagnosed with bacteriuria during pregnancy to ensure appropriate selection of antimicrobial agents, thereby reducing potential complications associated with this condition. Statistical analysis revealed significant differences in antibiotic resistance patterns between symptomatic and asymptomatic cases ($p<0.05$), with symptomatic isolates showing higher resistance rates, particularly to commonly prescribed first-line antibiotics. These findings should guide empiric therapy decisions while awaiting culture results.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data availability

All data obtained from this study are included in the current manuscript.

Ethical statement

The research received ethical approval from the Ethical Review Board (ERB) of the Ministry of Health, Kuwait (2024-2548).

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