Bacterial profile and antibiotic sensitivity pattern of UTI pregnant women in Thi-Qar Governorate, Iraq

By Hussain Saleh Farhood

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Bacterial profile and antibiotic sensitivity pattern of UTI pregnant women in Thi-Qar Governorate, Iraq

Hussain Saleh Farhood*, Saad Salman Hamim

Department of Pathological Analysis, College of Science, University of Thi-Qar, Iraq

***Corresponding:**

hussain.farhood@sci.utq.edu.iq

ABSTRACT

Background. UTIs are prevalent illnesses, particularly in pregnancy, caused by the presence and proliferation of bacteria in the urinary tract, with *E. coli* being the most prevalent pathogenic bacteria, accounting for 60–80% of cases.

Objective. The aim of the current study was to identify the frequency of bacteria that cause UTIs and their antibiotic resistance in pregnant mothers in Thi-Qar Governorate.

Material and Method. In the present study, 138 pregnant individuals were enrolled. Each participant provided urine samples, which cultivated on routine media followed by biochemical tests. The pathogenic bacteria were identified, and their antibiotic susceptibility was tested using the fully automated VITEK 2 compact system.

Result. The incidence ratio of positive urine culture was 82 (59.42%), whereas negative culture was 56 (40.58%) ($p \leq 0.025$). Bacterial culture findings of the GN isolates showed that *E. coli* was in the lead with 53 (88.3%) isolates. Conversely, *Enterobacter* spp. had the lowest isolation rate, with only two isolates (3.4%) ($p \leq 0.001$). According to the number of pregnancies, the first pregnancy had the highest infection rate for UTIs, with 31/82 (37.8%) ($p \leq 0.01$), and the prevalence of UTIs was relatively high in the O blood group, with 28 patients (34.14%) ($p \leq 0.05$). The third trimester had the highest infection rate, 60/82 (73.17%) ($p \leq 0.005$). The most sensitive antibiotics were 100% Tigecycline. The highest percentage of resistance was 75% found against Ciprofloxacin ($p \leq 0.001$).

Conclusion. UTIs, primarily caused by *E. coli*, pose a significant health risk for expectant mothers and can be reduced through antibiotic use, sustainable prenatal care, and health education.

Kew Words: Asthma, UTIs, *E. coli*, *K. pneumoniae*, Pregnancy, Antibiotic susceptibility test

INTRODUCTION

Pregnancy is a sequence of progressive changes to a woman's organs and tissues brought on by the growing fetus. These changes affect the urinary tract structurally, physiologically, and functionally, which in turn encourages the growth of bacteria in the bladder and results in infections in pregnant women's urinary tracts [1]. Urinary tract infection (UTIs) are the most common illness across all age groups, especially in pregnancy, and are generally brought on by the presence and proliferation of bacteria in the urinary tract [2]. Compared to non-pregnant women, pregnant women have a greater prevalence of the infection. A UTI is a severe health issue that affects 20% of pregnant women and is frequently the reason pregnant patients are admitted to obstetrical units [3,4]. This usually starts around week 6 and gets worse in weeks 22 to 24 of pregnancy for a variety of reasons, including urethral dilatation, an increase in bladder volume, and a decrease in both bladder tone and urethral tone. Both ureterovesical reflux and urine stasis are made worse by these conditions. About 70% of expectant mothers experience glycosuria, which promotes the development of germs in the urine [5]. The UTIs are caused by a substantial number of

microbiological organisms. While fungi, parasites, viruses, and other pathogens that grow in the urinary system can also cause UTIs, bacteria with gastrointestinal origins are the most common cause [6,7]. *Escherichia coli (E. coli)* is the most prevalent pathogenic bacteria linked to UTIs, accounting for 60–80% of cases [1,8]. Additional pathogens such as *Klebsiella pneumoniae (K. pneumoniae)*, *Proteus mirabilis, Staphylococcus saprophyticus, Enterococcus faecalis,* Group B *Streptococcus, Pseudomonas aeruginosa, Staph. aureus, and Candida* spp. are pertinent as infectious agents associated with hospitals and catheters [9,10] . The aim of the current study was to identify the frequency of bacteria that cause UTIs and their antibiotic resistance in pregnant mothers in Thi-Qar Governorate

MATERIALS AND METHODS

A. Design of Study

The present included 138 pregnant women who participated in a cross-sectional study. Urine samples were obtioned from patients ranging from 17 to 42 year whom were consulting Bint Al-Huda Teaching Hospital in Thi-Qar Governorate, Southern Iraq between August 2023 and January 2024.

B. Methods

Each participant provided urine samples, which were collected in sterile containers and brought to the lab for further examination. The urine samples were grown on MacConkey agar and blood agar. The positive growth samples underwent further analysis using Gram's stain, microscopic inspection. The pathogenic bacteria were identified, and their antibiotic susceptibility was tested using the fully automated VITEK 2 compact system [11,12].

C. Statistical Analysis

A chi-square test was employed, with ($P \leq 0.05$) being considered statistically significant. The graphs were made using Microsoft® Excel, 2016.

D. Ethical Permission

Thi-Qar Health Directorate has authorized the study under their agreement codded 265/2023.

RESULTS

The urine culture data indicated that the incidence ratio of positive urine culture was 82 (59.42%), whereas the negative urine culture was 56 (40.58%). The distribution of bacterial culture showed a statistically significant differences ($p \leq 0.025$), as shown in (Figure 1).

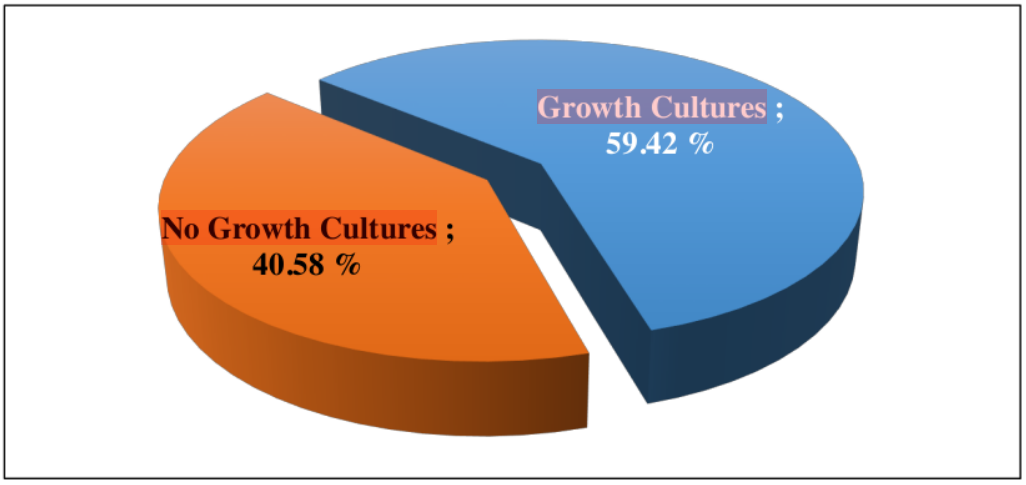

Figure 1. The proportion of non-growth to growth cultures.

As illustrated in (Figure 2), The current study results indicated that the third trimester, 60/82 (73.17%), had the greatest infection rate for pregnant women with UTIs, followed by the first trimester, 13/82 (15.85%), and the second trimester, 9/82 (10.98%). The trimesters distribution showed a high statistically significant differences ($p \leq 0.005$).

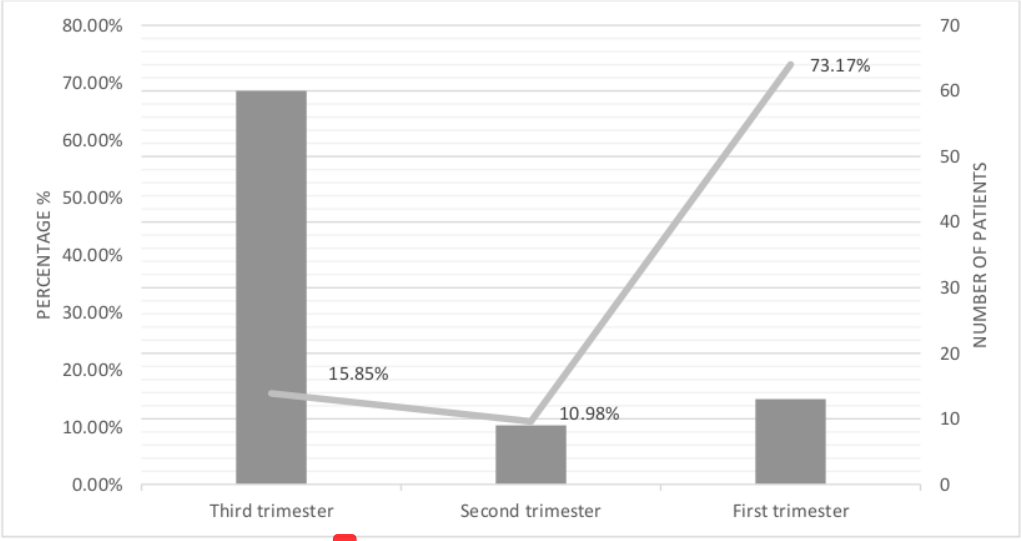

Figure 2. Relationship among trimesters of pregnancy and the percentage of infections.

The current study results indicated that the first pregnant had the most infection rate for UTIs pregnant women with 31/82 (37.8%). However, the eighth pregnant showed the lowest rates with only one case (1.2%). The number of Pregnancies distribution showed statistically significant differences ($p \leq 0.01$), as a shown in (Figure 3).

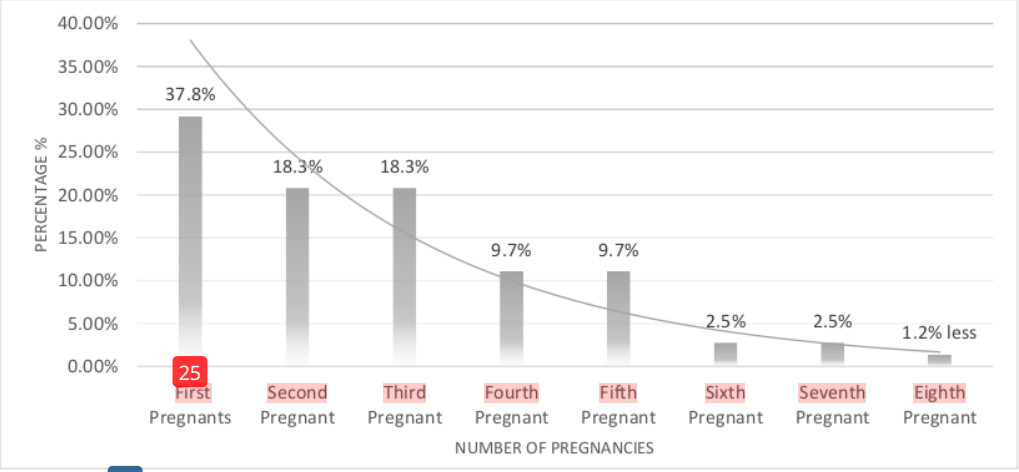

Figure 3. Pregnant women with UTI according to the number of pregnancies.

The current study results indicated that the prevalence of UTI was comparatively high among pregnant women in the O blood group with 28 patient (34.14%), followed by those in the B blood group, with 24 isolates (29.26%), and those in the A blood group, with 19 isolates (23.17%). On the other hand, those with AB blood group were at the back with 11 (13.43%). The blood group distribution showed statistically significant differences ($p \leq 0.05$), as shown in (Figure 4).

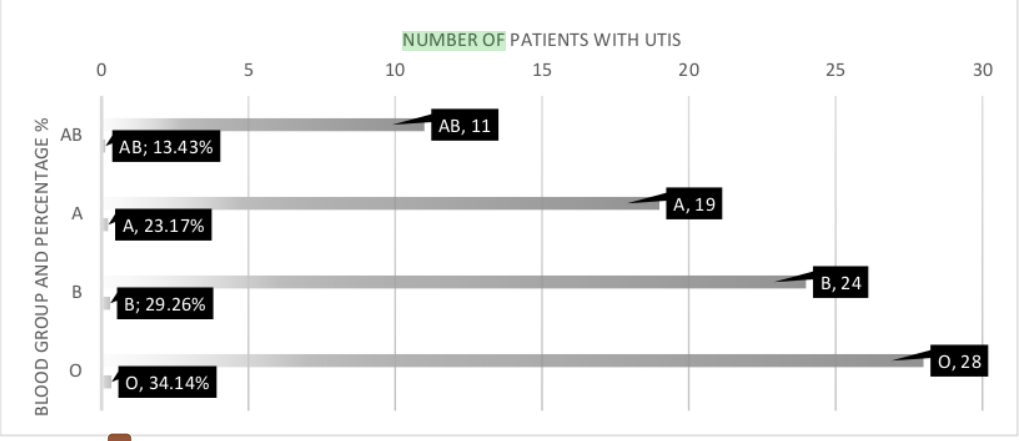

Figure 4. Pregnant women with UTI according to blood group.

According to the bacterial culture findings of the GN isolates in this investigation, with a high significant differences, were *E. coli* and *K. pneumoniae* accounted for 53 (88.3%) and 3 (5%), respectively. Conversely, *Enterobacter* spp. had the lowest isolation rate, with just two

isolates (3.4%). The GN bacterial distribution showed statistically significant differences ($p \leq 0.001$), as shown in (Table 1).

Table 1. GN bacteria that are causative agents of UTIs.

Bacteria	Number	Percentage (%)
E. coli	53	(88.3%)
Enterobacter aerogenes	1	(1.7%)
Enterobacter cloacae complex	1	(1.7%)
K. pneumoniae	3	(5%)
Unidentified Organism	2	(3.3%)
Total	**60**	**100%**

The antibiotic susceptibility test of all bacterial isolates was tested against 13 carefully chosen drugs. The findings demonstrated that the targeted microorganisms had varying resistance rates. The most sensitive antibiotics were 100% Tigecycline. The highest percentage of resistance was 75% found against Ciprofloxacin. Antibiotic susceptibility differed statistically significant ($p \leq 0.001$), as shown in (Figure 5).

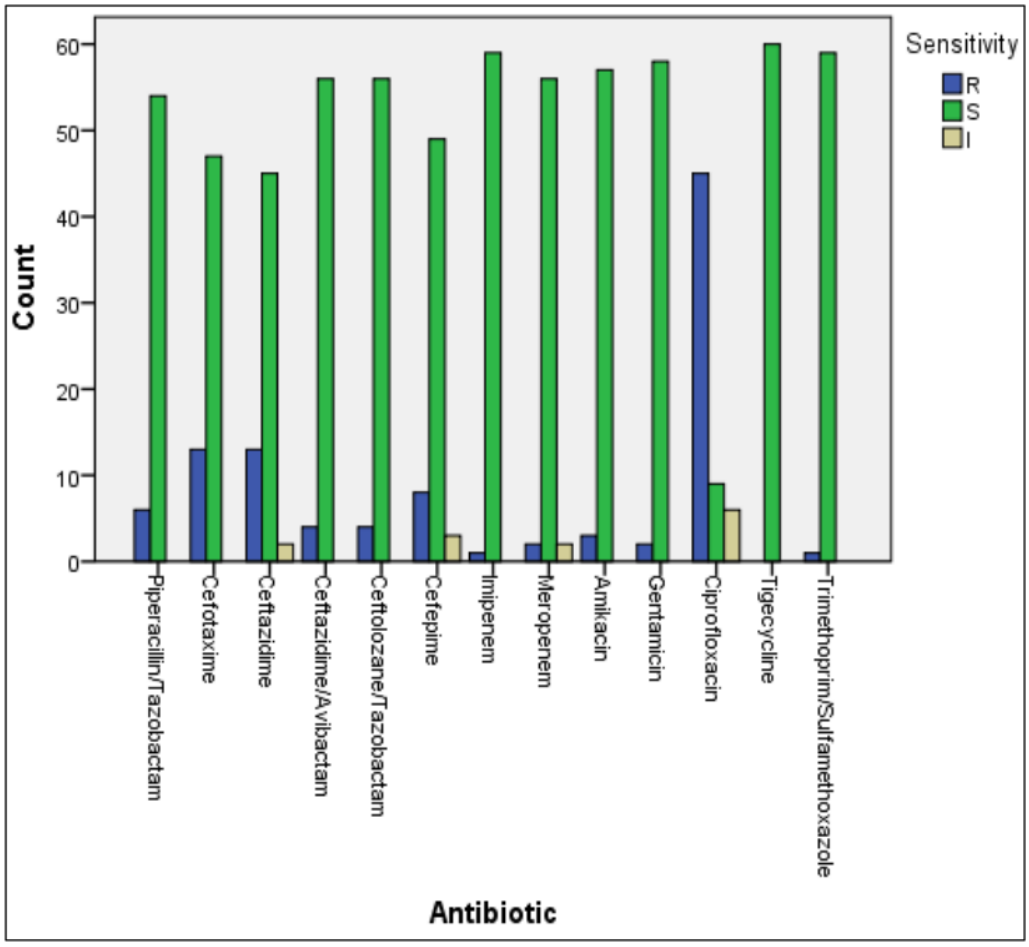

Figure 5. Antibiotic susceptibility test of UTI bacteria.

The findings demonstrated that the *E. coli* had varying resistance rates. The antibiotic susceptibility test differed statistically significantly ($p \leq 0.001$), as shown in (Taple 2).

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Table 2. Antibiotic susceptibility test of *E. coli* bacteria.

Antibiotics		Case			Total
		R	S	I	
Piperacillin \Tazobactam	Count	5	48	0	53
	%	9.4%	90.6%	0.0%	100.0%
cefotaxime	Count	6	47	0	53
	%	11.3%	88.7%	0.0%	100.0%
Ceftazidime	Count	10	42	1	53
	%	18.9%	79.2%	1.9%	100.0%
Ceftazidime \Avibactam	Count	4	49	0	53
	%	7.5%	92.5%	0.0%	100.0%
Ceftolozane \Tazobactam	Count	4	49	0	53
	%	7.5%	92.5%	0.0%	100.0%
Cefepime	Count	6	46	1	53

	%	11.3%	86.8%	1.9%	100.0%
Imipenem	Count	1	52	0	53
	%	1.9%	98.1%	0.0%	100.0%
Meropenem	Count	2	49	2	53
	%	3.8%	92.5%	3.8%	100.0%
Amikacin	Count	3	50	0	53
	%	5.7%	94.3%	0.0%	100.0%
Gentamycin	Count	2	51	0	53
	%	3.8%	96.2%	0.0%	100.0%
Ciprofloxacin	Count	43	5	5	53
	%	81.1%	9.4%	9.4%	100.0%
Tigecycline	Count	0	53	0	53
	%	0.0%	100.0%	0.0%	100.0%
Trimethoprim \Sulfamethoxazole	Count	1	52	0	53
	%	1.9%	98.1%	0.0%	100.0%
Total	Count	87	593	9	689
	%	12.6%	86.1%	1.3%	100.0%

DISCUSSION

A UTI can be caused by a wide variety of bacterial strains, *E. coli* and *K. pneumoniae* are the most common infections. Since both strains are present in the stool and urine of healthy women, there is no way for these illnesses to transfer between individuals [13]. The *E. coli* or *K. pneumonia* can become embedded in the urinary system due to a variety of circumstances, which can result in an infection. Certain women are more susceptible to UTIs due to certain risk factors, such as compromised immune systems or long-term renal issues [14].

One of the most common uropathogenic bacteria is *E. coli*, which is distinguished by a number of virulence characteristics unique to the colonization and invasion of the urinary epithelium. It is also linked to bacteria rising from fecal flora contaminated perurethral regions because of the anus's proximity and the warm, humid environment [15]. Numerous variables are linked to *K. pneumonia* pathogenicity. Capsular antigens (O and K antigens), siderophores, adhesives, and lipopolysaccharides (LPS) (endotoxins) were shown to be the most pathogenic components. The most significant virulence component is the polysaccharide capsule, which can stop the host organism from undergoing opsonophagocytosis and eliminate the bacteria. A total of 77 capsules were examined, and *Klebsiella* spp. tend to be less virulent when they lack capsules [16]. A second virulence component that coats the outside of GN bacteria is LPS. The host organism is exposed to an inflammatory cascade through the LPS feeling, which has been identified as a major cause of sepsis and septic sequelae [17]. Siderophores are an additional virulence factor that the bacterium employs for its host [18]. Siderophores take iron from their host to facilitate the contaminated organism's spread [19]. A wide variety of microorganisms generate siderophores, which are tiny, highly affinity iron chelating molecules that are crucial to the pathogenicity of certain GN bacteria. *K. pneumoniae* and *E. coli* secrete siderophores that are necessary for the development and reproduction of bacteria [20].

A greater mechanical blockage resulting from a gravid uterus might be the reason for the higher occurrence during the third trimester, most expectant mothers seek prenatal care in the

second or third trimester [21]. Because of anatomical and physiological changes, pregnant women in their third trimester are more likely to get UTIs [22]. This variation may result from altered urine stasis, vesicoureteral reflux, or a decrease in progesterone and estrogen levels in the urine during the trimester of pregnancy [23].

The UTIs are more common in pregnant women who have had more pregnancies or who have higher parity [24]. Because a larger uterus puts pressure on the ureter and the bladder's descending portion, which causes urine stasis and accelerated multiplication, multigravidas have the highest frequency of UTIs [25].

Additional defense chemicals called cytokines and chemokines are produced by the urothelium and resident immune cells, and they draw inflammatory cells to the diseased area. Together, resident and recruited immune cells eliminate bladder bacteria and create an immunological memory that resists infection for a long time. Nevertheless, recurrent UTIs indicate that bladder memory response development may not be sufficient to stop reinfection. Furthermore, infection appears to cause enduring alterations in the urothelium, perhaps making the tissue more vulnerable to infection in the future [26].

ABH and Lewis antigens, which serve as attachment receptors for bacteria, parasites, and viruses, can also be expressed by epithelial cells. This increases a person's susceptibility to infections based on their antigenic profile. Molecular mimicry is the term for the phenomenon where certain infections have antigens that resemble the blood group antigens of their hosts. Microbes exploit this mimicry as a defense strategy against the immune systems of their hosts [27].

Due to disruption of the microbiome, repeated antibiotic use after recurring infections can cause urogenital and intestinal dysbiosis, as well as perhaps other health problems [28]. Even more concerningly, the widespread use of broad-spectrum antibiotics to treat recurrent UTIs has contributed to the dire reality of antibiotic resistance in common uropathogens [29].

Pregnant women who practice good sexual and genital hygiene are far less likely to have UTIs, which might result in problems and a lower risk of premature birth [30]. The link between frequent swabbing, recent coitus, and antibiotic resistance in sexually active women and UTIs highlights the need for targeted public health interventions [31].

Variations in sample size, regional variance, socioeconomic status, awareness, and predisposing variables might all be responsible for the variation in results [32]. Negative growth can be caused by a variety of factors, such as the overuse of antibiotics or other infectious agents, including fungus, viruses, or anaerobic bacteria [33].

CONCLUSION

Urinary tract bacterial infections remain a serious health concern for expectant mothers, particularly in the third trimester of pregnancy. The most common bacteria now causing UTIs during pregnancy is *E. coli*. Thus, the incidence of UTIs may be basically decreased.

Conflict of interesting

None

REFERENCES

1. Belete MA, Saravanan M. A systematic review on drug resistant urinary tract infection among pregnant women in developing countries in Africa and Asia; 2005–2016. Infection and drug resistance. 2020:1465-77. [DOI: 10.2147/IDR.S250654]
2. Ranjan A, Sridhar STK, Matta N, Chokkakula S, Ansari RK. Prevalence of UTI among pregnant women and its complications in newborns. Indian Journal of Pharmacy Practice. 2017;10(1). [DOI: 10.5530/IJOPP.10.1.10]
3. Tchatchouang S, Bigna JJ, Nzouankeu A, Fonkoua M-C, Nansseu JR, Ndangang MS, et al. Prevalence of respiratory bacterial infections in people with lower respiratory tract infections in Africa: the BARIAFRICA systematic review and meta-analysis protocol. BMJ open. 2018;8(9):e023592. [DOI: 10.1136/bmjopen-2018-023592]
4. Ali AH, Reda DY, Ormago MD. Prevalence and antimicrobial susceptibility pattern of urinary tract infection among pregnant women attending Hargeisa Group Hospital, Hargeisa, Somaliland. Scientific Reports. 2022;12(1):1419. [DOI: 10.1038/s41598-022-05452-z]
5. Alemu A, Moges F, Shiferaw Y, Tafess K, Kassu A, Anagaw B, et al. Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at University of Gondar Teaching Hospital, Northwest Ethiopia. BMC research notes. 2012;5:1-7. [DOI: 10.1186/1756-0500-5-197]
6. Ismael LA, Aubaid SH, Nasir HM. Estimating the Level of Interleukin-22 in Sera of Patients with Uropathogenic Escherichia coli Infection in Mosul City. Rafidain journal of science. 2022;31(2). [DOI: 10.33899/rjs.2022.174269]
7. Vasudevan R. Urinary tract infection: an overview of the infection and the associated risk factors. J Microbiol Exp. 2014;1(2):00008. [DOI: 10.15406/jmen.2014.01.00008]
8. Saadon H, Khudhur SG, Obaid HA, Shakir H, Salman NA, Al-Ali HA. Detection of Antibiotic Resistance among Gram-Negative Bacteria Isolated from Urinary Tract Infections. University of Thi-Qar Journal of Science. 2024 Jun 1;11(1):83-7.[https://doi.org/10.32792/utq/utjsci/v11i1.1195]
9. Abbas A, Hamim SS. Serological and Molecular detection of Staphylococcus aureus isolated from UTI patients. University of Thi-Qar Journal. 2019;14(3):64-79. [DOI: 10.32792/utq/utj/vol14/4/5]
10. Chakrabarty S, Mishra MP, Bhattacharyay D. Targeting microbial bio-film: an update on MDR gram-negative bio-film producers causing catheter-associated urinary tract infections. Applied Biochemistry and Biotechnology. 2022;194(6):2796-830. [DOI: 10.1007/s12010-021-03711-9]
11. Beden MW, Mousa HM. Bacteriuria with Unusual Uropathogens in Diabetics in Thi-Qar Province. University of Thi-Qar Journal of Science. 2022;9(1):43-8. [DOI: 10.32792/utq/utjsci.v9i1.875]
12. Ahmed SS, Shariq A, Alsalloom AA, Babikir IH, Alhomoud BN. Uropathogens and their antimicrobial resistance patterns: Relationship with urinary tract infections. International Journal of Health Sciences. 2019;13(2):48. [PMCID: PMC6436442] [PMID: 30983946]

13. Vachvanichsanong P, McNeil E, Dissaneewate P. Extended-spectrum beta-lactamase Escherichia coli and Klebsiella pneumoniae urinary tract infections. Epidemiology & Infection. 2021;149:e12. [DOI: 10.1017/S0950268820003015]
14. Yamasaki S, Shigemura K, Osawa K, Kitagawa K, Ishii A, Kuntaman K, et al. Genetic analysis of ESBL-producing Klebsiella pneumoniae isolated from UTI patients in Indonesia. Journal of Infection and Chemotherapy. 2021;27(1):55-61. [DOI: 10.1016/j.jiac.2020.08.007]
15. Gessese YA, Damessa DL, Amare MM, Bahta YH, Shifera AD, Tasew FS, et al. Urinary pathogenic bacterial profile, antibiogram of isolates and associated risk factors among pregnant women in Ambo town, Central Ethiopia: a cross-sectional study. Antimicrobial Resistance & Infection Control. 2017;6:1-10. [DOI: 10.1186/s13756-017-0289-6]
16. Effah CY, Sun T, Liu S, Wu Y. Klebsiella pneumoniae: an increasing threat to public health. Annals of clinical microbiology and antimicrobials. 2020;19(1):1-9. [DOI: 10.1186/s12941-019-0343-8]
17. Pal M, Lema AG. Current Perceptive on the Virulence Factors of Yersinia Enterocolitica: A Critical Review. American Journal of Infectious Diseases. 2022;10(1):7-10. [DOI: 10.12691/ajidm-10-1-2]
18. Rodrigues C, d'Humières C, Papin G, Passet V, Ruppé E, Brisse S. Community-acquired infection caused by the uncommon hypervirulent Klebsiella pneumoniae ST66-K2 lineage. Microbial genomics. 2020;6(8). [DOI: 10.1099/mgen.0.000419]
19. Liu W, Lu H, Chu X, Lou T, Zhang N, Zhang B, et al. Tea polyphenols inhibits biofilm formation, attenuates the quorum sensing-controlled virulence and enhances resistance to Klebsiella pneumoniae infection in Caenorhabditis elegans model. Microbial pathogenesis. 2020;147:104266. [DOI: 10.1016/j.micpath.2020.104266]
20. Khasheii B, Mahmoodi P, Mohammadzadeh A. Siderophores: Importance in bacterial pathogenesis and applications in medicine and industry. Microbiological Research. 2021;250:126790. [DOI: 10.1016/j.micres.2021.126790]
21. Ali M, Abdallah MS. Prevalence of urinary tract infection among pregnant women in Kano, Northern Nigeria. Arch Reprod Med Sex Health. 2019;2(1):23-9.
22. Patel KV, Sahni S. BACTERIAL PROFILE AND DRUG SUSCEPTIBILITY PATTERN OF ASYMPTOMATIC BACTERIURIA IN PREGNANCY & ITS ASSOCIATION WITH GESTATIONAL AGE. Global journal for research analysis. 2018;7. [DOI: 10.36106/gjra]
23. Lawani EU, Alade T, Oyelaran D. Urinary tract infection amongst pregnant women in Amassoma, Southern Nigeria. African journal of microbiology research. 2015;9(6):355-9. [DOI:10.5897/AMR20147323]
24. Ezugwu IA, Afunwa RA, Onyia FC, Chukwunwejim CR, Offe IM, Onyia CO, et al. Prevalence of urinary tract infections and associated risk factors among pregnant women in Enugu Metropolis, Nigeria. Journal of Biosciences and Medicines. 2021;9(10):156-71. [DOI: 10.4236/jbm.2021.910014]
25. Nwachukwu E, Onyebuchi O, Michael O. Prevalence of urinary tract infections in pregnant women in Onitsha, Nigeria. J Bacteriol Mycol Open Access. 2018;6(5):284-5. [DOI: 10.15406/jbmoa.2018.06.00219]

26. Lacerda Mariano L, Ingersoll MA. The immune response to infection in the bladder. Nature Reviews Urology. 2020;17(8):439-58. [DOI: 10.1038/s41585-020-0350-8]
27. Yamamoto F, Cid E, Yamamoto M, Blancher A. ABO research in the modern era of genomics. Transfusion medicine reviews. 2018;26(2):103-18. [DOI: 10.1016/j.tmrv.2011.08.002]
28. Hrbacek J, Cermak P, Zachoval R. Current antibiotic resistance trends of uropathogens in Central Europe: Survey from a Tertiary hospital urology department 2011–2019. Antibiotics. 2020;9(9):630. [DOI: 10.3390/antibiotics9090630]
29. Murray CJ, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The lancet. 2022;399(10325):629-55. [DOI: 10.1016/S0140-6736(21)02724-0]
30. Haghdoost S, Pazandeh F, Khabazkhoob M, Bhroozi R. Assocoation Between Sexual and Genital Hygiene Habits with the Urinary Tact Infectin During Pregnancy: A Case-Control Study. International Journal of Women's Health and Reproduction Sciences. 2020;8(2):158-63. [DOI:10.15296/ijwhr.2020.25]
31. Seid M, Markos M, Aklilu A, Manilal A, Zakir A, Kebede T, et al. Community-Acquired Urinary Tract Infection Among Sexually Active Women: Risk Factors, Bacterial Profile and Their Antimicrobial Susceptibility Patterns, Arba Minch, Southern Ethiopia. Infection and Drug Resistance. 2023:2297-310. [DOI: 10.2147/IDR.S407092]
32. Edae M, Teklemariam Z, Weldegebreal F, Abate D. Asymptomatic bacteriuria among pregnant women attending antenatal care at Hiwot Fana specialized university hospital, Harar, eastern Ethiopia: magnitude, associated factors, and antimicrobial susceptibility pattern. International Journal of Microbiology. 2020;2020. [DOI: 10.1155/2020/1763931]
33. Ciofu O, Tolker-Nielsen T, Jensen PØ, Wang H, Høiby N. Antimicrobial resistance, respiratory tract infections and role of biofilms in lung infections in cystic fibrosis patients. Advanced drug delivery reviews. 2015;85:7-23. [DOI: 10.1016/j.addr.2014.11.017]