Clinical and Microbiological Risk Factors of Urinary Tract Infections in Pregnancy women of Kerbala city

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Abstract

Background: Urinary tract infections (UTIs) are among the most common bacterial infections during pregnancy represent a significant public health concern due to their potential complications for both the mother and the fetus. Pregnancy-related physiological and anatomical changes increase susceptibility to UTIs. The aim of this study is to, Identify the main clinical risk factors contributing to urinary tract infections during pregnancy, Determine the most common microbiological pathogens responsible for UTIs in pregnant women, Assess the potential maternal and fetal complications associated with UTIs.

Methods: Using a structured questionnaire, 200 pregnant patients who met the inclusion criteria and visited the obstetrics and gynecology clinic between January, 2026, and March, 2026, were included. A structured interview was used to gather the sample, and the pregnant women obtained enough clean-catch midstream pee specimens after receiving thorough instructions on how to do so.

Results: According to the study's findings, 72% of the women under investigation had positive urine cultures for infections. The majority of the isolated pathogens were *E. coli* (56%) followed by *Klebsiella spp* (22.2%),*Pseudomonas spp* (8.3%), *Proteus spp* (4.8%), *Enterobacter spp* (4.1%), and *Staphylococcus spp* (2.7%),

The most prevalent clinical symptoms among infected women included frequent micturition, dysuria, lower abdomen pain, urine color change, severe burning sensation, and incomplete bladder evacuation. Given that the symptoms are a reliable indicator of a urinary tract infection during pregnancy, therefor early screening programs for pathogens and proper treatment for infected cases should be applied.

Conclusion: In conclusion, the study indicates that while socio-demographic and most obstetric factors are not major determinants of culture positivity, behavioural habits, underlying metabolic disease, previous urinary tract infection, and clinical symptoms play a significant role in predicting infection. These findings emphasize the importance of early screening, health education, and proper

Keywords: An antibacterial agent; Pregnant women; Urinary tract infection; Risk Factors; pathogen

1. Introduction

Urinary Tract Infections (UTIs) are by far the most prevalent bacterial infections among women, specifically those that are pregnant. It is very common for patients to experience failed treatment and relapses from these infections. Urinary tract infections are encouraged during pregnancy due to anatomical, physiological, and functional changes that facilitate bacteria being introduced into the bladder (Matuszkiewicz-Rowińska et al., 2015). As urinary tract infections are more prevalent in pregnant women than other healthy female members of the general population, (Czajkowski *et al*., 2021) and the changes in both the immune and urinary systems during the course of gestation results in increased chances of bacteriuria that can jeopardize both the mother and fetus. The impact of both symptomatic and asymptomatic UTIs in pregnant women and increases negative outcomes for all parties involved (Baimakhanova et al., 2025) .

Several factors, including the number of births, older maternal age, sickle cell disease, diabetes, prior urinary tract issues, and a past history of UTIs, can increase urinary tract infection risk among expectant mothers (Abbasi et al., 2025). Pregnant women who have UTIs that go untreated face serious risks, including preterm delivery, low birth weight, elevated blood pressure, preeclampsia, anemia, kidney infection, amniotic fluid infection, stillbirth, and newborn death. One way to reduce these potential negative outcomes is by promptly administering antibiotics to infected mothers (Melo et al., 2025). Therefore, routine testing followed by timely management is vital to avoid adverse results (Melo et al., 2025). The rate at which pregnant women in Kerbala experience UTIs has been reported as high as 49.4%. UTIs typically result from bacteria (primarily from the intestines) that colonize the area surrounding the urethral opening and ascend into the bladder from there (Al-*baiaty et al.,* 2024).

Escherichia coli (*E. coli*), *Staphylococcus species*, *Streptococcus species*, *Proteus species*, *Klebsiella species*, and *Pseudomonas species* are some of the more common pathogenic microorganisms leading to urinary tract infections (UTIs). The severity of UTIs will depend on an individual's susceptibility to infection and the virulence of the microorganisms involved. Many (UTIs) can be treated effectively with antibiotics such as cefoxitin, amoxicillin, ceftazidime, norfloxacin and penicillin (You et al., 2026). *Proteus species* is the most commonly isolated organism causing UTIs in persons with complicated UTIs or those who have a long-term urinary catheter. Although it is generally treatable with antibiotics, treatment can often be problematic. Some researchers have suggested that antibiotic treatment can potentially shield bacteria from exposure to the stone matrix. Some of the more rare bacteria can also result in UTIs (Safa'a Mohammed et al., 2024).

Hormones, physiology, and anatomy can change while pregnant and by doing this, the receptors that are found in the urinary system can change as well. This change increases the specificity for the infection that is found in the urinary system during pregnancy in women. Asymptomatic bacteriuria that has not been treated has a 20 – 30 percent chance of leading to acute pyelonephritis; it is also associated with an increased risk of having a low birth weight or preterm delivery. It is very important that urinary tract infections be diagnosed through comprehensive screening and also that all asymptomatic bacteriuria (ASB) be treated during pregnancy in order to prevent morbidities of pregnancy (Mahmoud, 2025). The primary focus of this study is the detection and prevalence of UTIs in pregnant women in Kerbala city.

2. Materials and Methods

The sample population in the study were made up of 200 pregnant females attending the first antenatal clinic in Kerbala city between January 1st , 2026 to March 31st. Inclusion criteria for all participants and female participants in the second trimester were included should have experienced at least 1 of the following types of clinical symptoms indicative (suspicious) of having a urinary tract infection (UTI): (1) frequent urination, (2) fever, (3) dysuria (painful) burning, (4) strangury, (5) incomplete emptying of the bladder after urination (6), pain in lower abdomen or flank, (7) change in urine color, and (8) chills.

The criteria for exclusion from the study included women with sickle cell disease who had renal damage and women who had congenital defects or functional problems of the urinary tract, as well as women who had received any antibiotic treatment in the past 72 hours because the use of antibiotics could have suppressed or removed the organisms responsible for the study outcomes.

Data collection occurred, through structured interviews with respondents, addressing their demographics (age, education, occupation, and income) and obstetric (number of pregnancies/deliveries/abortions/children) and medical histories (e.g., regular frequency of urination, adequate water intake, amount of caffeine, vitamin C consumed, stored tea consumed vs. fresh tea consumed) respectively, which included (but were not limited to) information about whether or not respondents .

2.1 Urine sample technique

A sufficient amount of clean-catch midstream urine sample was obtained by the pregnant women after given adequate and careful instructions for urine sample collection technique.

Blood agar plates and MacConkey agar were inoculated with the urine sample from the patients. The urine sample plates were then incubated for 24 hours at 37°C under ideal aerobic conditions. The urine culture plates were observed macroscopically after 24 hours to observe colony color, morphology, appearance and size. The isolated organisms were identified using both a gram stain and biochemical testing such as Oxidase test, Catalase test, mannitol fermentation, coagulase test and by examining them microscopically . The presence of leukocytes (LE) and nitrates in urine was screened by using biochemical reagent strip tests (dipstick test). A microscope was used to examine red blood cells (RBC) and pus cells (pyuria) in urine (Jalali et al., 2014) .

2.2 Statical Analysis

Using the social sciences statistical software package (MiniTab statistical software version17, IBM (Pennsylvania, USA)), statistical analysis was conducted and the results were expressed as mean±standard deviations (Mean±S.D). Using Student's t-test for two independent means and one way ANOVA for more than two independent means, statistical analysis was conducted on the importance of quantitative data differences (P-values of around <0.05) (Al Ghanmi,2016).

3. Results

Table 1. Comparison of Demographic and Obstetric Characteristics Between Women With Positive and Negative Culture Results.

The Parameter	Women with NEGATIVE culture (n=56)	Women with POSITIVE culture (n=144
Mean±SD (Age)	29.8 ± 7.5	29.8 ± 7.3
Mean±SD (NO. of pregnancies)	3.6± 2.0	3.5 ± 2.1
(Mean±SD)Abortions	0.9 ± 0.9	0.8 ± 1.0

Table (1) provides a demographic comparison of the obstetric characteristics of women having a negative Culture Results (n=56) and women having a positive Culture Results (n=144). Mean age across both Groups is the same (29.8) with the standard deviations also being similar (7.5 and 7.3 respectively), thus indicating there is no significant difference between the age of the two Groups.

For reproductive history, the mean number of pregnancies was similar for women with negative cultures (3.6 ± 2.0) compared to those with positive cultures (3.5 ± 2.1). Furthermore, there was very little difference in the mean number of abortions between both groups, with an average number of abortions of 0.9 ± 0.9 for women with negative cultures and an average of 0.8 ± 1.0 for women with positive cultures.

Table 2. Frequency of bacteria isolated from pregnant women with UTIs.

The Isolate	Number of pathogens	The percentage
E.coli	82	56.9%
Klebsiella spp	32	22.2%
Pseudomonas spp	12	8.3%
Proteus spp	7	4.8%
Enterobacter spp	6	4.1%
Staphylococcus spp	4	2.7%
Total	144	72%

Table (2) a representation of 200 pregnant females who had isolated pathogens. 144 or 72% of the participants had a pathogen in their urine cultured and identified. *Escherichia coli (E. coli)* isolated the most, with 82 total identified and isolated (56.9%), confirming it is the most abundant pathogen in women studied for UTIs.

In this study, the primary pathogens produced by those patients with culture-positive samples of Gram-negative bacteria were *Escherichia coli*, which represented over half of all the bacteria detected amongst the sample population studied.

Table 3. The Socio-demographic characteristics and the obstetric history of the studied pregnant women (n=200).

Socio-demographic characteristics	**Women with negative culture (n = 56)**		**Women with positive culture (n = 144)**		**Statistic test P value**
	No.	**%**	**No.**	**%**	
Age (years)					
Less than 25	16	28.5%	39	27.1%	χ^2=0.109 p=0.947 NS
25 – <35	25	44.6%	68	47.2%	
35 – ≤45	15	26.8%	37	25.7%	
Occupation					
Work	21	37.5%	73	50.7%	χ^2=2.313 p=0.128 NS
Housewife	35	62.5%	71	49.3%	
Family income					
Insufficient	15	26.8%	44	30.6%	χ^2=0.124 p=0.725 NS
Moderate	41	73.2%	100	69.4%	
Number of pregnancies					
1 – 2	21	37.5%	53	36.8%	χ^2=0.050 p=0.976 NS
3 – 4	18	32.1%	49	34.0%	
5 or more	17	30.4%	43	29.9%	
Min – Max	1 – 8		1 – 10		
Abortions					
None	30	53.6%	95	65.9%	**χ^2=2.585 p=0.275 NS**
1 – 2	19	33.9%	36	25.0%	
3 – 4	7	12.5%	25	17.4%	
Min – Max	0 – 3		0 – 4		
Previous treatment for UTI during current pregnancy					
Yes	20	35.7%	100	69.4%	χ^2=17.734 p=< 0.001 S
No	36	64.3%	44	30.6%	

Note :n: number of cases, χ^2: Chi-squared test, NS: Non-significant difference between groups (p value > 0.05), S: Significant association between groups (p value ≤ 0.05)

Table 3 shows the socio-demographic and obstetric characteristics of women by culture status (negative culture n = 56; positive culture n = 144). Overall, the majority of variables showed no statistically significant difference between groups, with the exceptions of history of treatment for urinary tract infection (UTI) in the current pregnancy.

The total sample of study participants analyzed by the data source used for this study (the sample was also linked to data from the National Birth Cohort Study), the largest group of respondents were aged between 25 and <35 years with similar distribution across all age categories. Culture tests and maternal age did not have a significant correlation (χ^2= 0.109, p= 0.947) thus indicating that maternal age did not impact whether the culture test was positive.

There is a slight difference in the number of people employed in both cultures but this is not statistically significant. Families' income level does not differ between both cultures but most earn moderate incomes.

In terms of obstetric histories, the number of pregnancies and abortions reported by both groups were very similar; thus no statistical significance was detected (pregnancy x2= 0.050, p-value = 0 .976; abortion x2= 2.585, p- value = 0.275). These findings suggest that reproductive history is not an indicator of culture positive status in this specific population studied.

The analysis showed that there was a statistically significant difference between the women that had positive cultures and those that had negative cultures regarding treatment for UTI received in their current pregnancy (χ^2 = 17.734, p < 0.001). Women with positive cultures were more likely to have received treatment for a previous UTI. Therefore, it is suggested that past infections or treatments may predispose women to recurrent/persistent infection and/or may not have completely eradicated the causative organism(s).

The overall findings show that there was not a significant relationship between socio-demographic factors or the majority of obstetric factors and the culture result, while the treatment of UTIs prior to this culture was a significant factor associated with the positive culture.

Table 4. The predisposing factors and clinical manifestations of the studied pregnant women (n=200).

Predisposing factors	**Women with NEGATIVE culture (n = 56)**		**Women with POSITIVE culture (n = 144)**		**Significance test**
	No.	**%**	**No.**	**%**	
Health-related habits during pregnancy					
Vitamin C intake	42	75.0%	65	45.1%	χ^2=13.277 p=< 0.001 S
Regular bladder voiding	50	89.3%	96	66.7%	χ^2=9.350 p=0.002 S
Frequent soft drinks consumption	26	46.4%	105	72.9%	χ^2=11.374 p=0.001 S
Frequent tea consumption	20	35.7%	99	68.8%	χ^2=16.915 p=< 0.001 S
Frequent coffee consumption	22	39.3%	87	60.4%	χ^2=6.433 p=0.011 S

Predisposing factors	Women with NEGATIVE culture (n = 56)		Women with POSITIVE culture (n = 144)		Significance test
Drinking enough water	49	87.5%	90	62.5%	χ^2=10.738 p=0.001 S
Medical history					
Genital tract infection	19	33.9%	46	31.9%	χ^2=0.010 p=0.920 NS
Hypertension	15	26.8%	57	39.6%	χ^2=2.338 p=0.126 NS
Kidney stones	9	16.1%	19	13.2%	χ^2=0.090 p=0.765 NS
Diabetes Mellitus	7	12.5%	50	34.7%	χ^2=8.711 p=0.003 S
Previous urinary tract infection	13	23.2%	106	73.6%	χ^2=40.431 p=< 0.001 S
Anemia	24	42.9%	56	38.9%	χ^2=0.125 p=0.724 NS
Clinical manifestations					
Painful burning sensation	25	44.6%	111	77.1%	χ^2=18.038 p=< 0.001 S
Incomplete bladder voiding	16	28.6%	97	67.4%	χ^2=23.131 p=< 0.001 S
Frequency of urination	27	48.2%	130	90.3%	χ^2=39.814 p=< 0.001 S
Fever	15	26.8%	99	68.8%	χ^2=27.282 p=< 0.001 S
Strangury	14	25.0%	88	61.1%	χ^2=19.619 p=< 0.001 S
Dysuria	9	16.1%	117	81.3%	χ^2=70.714 p=< 0.001 S
Shaking chills	10	17.9%	50	34.7%	χ^2=4.687 p=0.030 S
Flank pain	22	39.3%	90	62.5%	χ^2=7.901 p=0.005 S
Change urine color	7	12.5%	120	83.3%	χ^2=84.254 p=< 0.001 S
Lower abdominal pain	16	28.6%	110	76.4%	χ^2=37.526 p=< 0.001 S
Hematuria	1	1.8%	28	19.4%	χ^2=8.767 p=0.003 S
Pyuria	10	17.9%	120	83.3%	χ^2=73.130 p=< 0.001 S

Table (4) show The relationship between the predisposing factors and the culture results was evaluated by looking at the differences in the culture results of women that had negative (n = 56) and positive (n = 144) results of their cultures. The results show that many health-related habits, history of medical problems, and clinical presentation were statistically associated with positive culture results.

Women who tested positive for cultures consumed soft drinks, tea, and coffee at higher frequencies than those who tested negative. Women who had cultures that were negative tended to have better protective behaviours, such as frequently taking vitamin C, urinating regularly, and drinking enough water. Overall, it appears that dietary and urinary habits may contribute to the susceptibility to develop a yeast infection.

The two variables analyzed during this study that demonstrated a statistically significant association with culture status were: 1) diabetes mellitus ($p = 0.03$) and 2) history of recurrent urinary tract infection ($p < 0.001$); therefore, it appears that metabolic disorders and those with a history of recurrent infections are at increased risk for developing urinary tract infections while pregnant.

The clinical signs and symptoms (including dysuria, frequency of urination, burning as well as feeling of incomplete bladder emptying, fever, flank pain, and pus in the urine) that were reported were much higher in women who had positive urine cultures ($p < 0.05$). Dysuria, as well as a change in colour of urine and pueryria, had a very strong association with the diagnosis of a culture-positive urinary tract infection ($p < 0.001$).

On the whole, these results indicate that there is a strong relationship between lifestyle factors, metabolic states, prior UTI, and clinical symptoms with regards to whether cultures return positive or negative; on the other hand, the vast majority of chronic health issues do not have a significant relationship to culture results..

4. Discussion

The current study indicates that 72% of all pregnancies were diagnosed with an UTIs in this sample, this percentage significantly exceeds the previous studies' rates. According to Al-baiaty et al. (2024) ,the rate was 49.4% in Kerbala city (2024), and it was found to be 31% in Baghdad (Mohamed & Nassir, 2025) . Additionally, (Abdulla & Oleiwi, 2016) found that UTIs rates among pregnant women in Al-Najaf was 37%.

Escherichia coli was the predominant bacterium in urine cultures obtained from pregnant women (56.9%), followed by *Klebsiella spp* (22.2%). *Staphylococcus spp* was the least common bacterium found in these same specimens (2.7%). The study's authors, Rahiman et al. (2015) suggested that the increase in the acidity of urine during pregnancy may create an environment conducive to the proliferation of *E. coli* within the urinary tract. The present study's findings are consistent with numerous other studies that have identified *E. coli* as the primary cause of urinary tract infection; these studies include those conducted by Ebidor et al. (2015), Mohamed and Nassir (2025), and Al-Hayali (2026). However, Mishra et al. (2016) found that *Staphylococcus spp* was the most common pathogen isolated from asymptomatic pregnant women .

Additionally, this can be evidenced by the cessation of urine during pregnancy due to physiological and anatomical alterations of the urinary tract (i.e., compression of ureters by a growing uterus and the relaxing effect of progesterone on urinary tract muscle). In addition, evidence from Emiru et al. (2013) shows that diabetes mellitus or recurrent urinary tract infections increases the risk for UTIs, thus contributing to increased incidence and severity of UTIs during pregnancy.

According to the current study findings, there are statistically significant differences between the existence of bacteria in urine cultures, associated with the presence of different urinary symptoms associated with urination include: frequency of micturition, painful urination (dysuria), pain in the lower abdomen, dark colored urine, and painful burning sensations upon urination or a feeling that

the bladder has not completely emptied. Results from this study concurred with (El-Kashif, 2019) who published similar findings. There was also a statistically significant difference between the presence of pathogens in urine samples based on laboratory findings such as pyuria and haematuria (p=<0.001) in the present study. This finding agrees with (Michelim et al., 2016) who showed that most women diagnosed with pyelonephritis had pyuria present in their urine sample.

According to the present study, there were no statistically significant differences (P>0.05) between women with positive and negative urine cultures with regard to age, occupation, household income, history of abortions, and number of times given birth .Ebidor et al. (2015) found that UTIs were common among women of different age brackets, but incidence and prevalence rates tend to increase as women get older. Also, Kolawole et al. (2009) found that socioeconomic status was an important factor in the occurrence of urinary pathogens, possibly due to inadequate access to safe housing, lack of drainage systems, and poor personal and environmental hygiene. Based on this researcher's opinion, low socioeconomic status may also lead to poor nutrition and a weakened immune system during pregnancy, both of which may lead to higher rates of infections.

Results similar to those obtained in this study were reported by Tamalli et al. (2013), who demonstrated that bacteriuria occurred in 9% of healthy women; however, the prevalence was increased to 21% among pregnant women with low socioeconomic status. The authors also noted high rates of urinary tract infection UTIs among employed women. It may be that women who work do not consume adequate amounts of water while at work. Additionally, 66.7% of women with positive urine cultures had a prior UTIs during the index pregnancy which had a statistically significant correlation ($P \leq 0.05$). As noted by McCormick et al. (2008), physiologic changes in the immune system due to pregnancy help to facilitate the implantation and growth of the fetus. The humoral immune response shifts to a predominately (rather than a primarly) cell-mediated immune response, resulting in a decrease in the ability of the body to kill bacteria through use of their surface proteins and aiding the invasion, reproduction and colonization of bacteria in the urinary tract.

Additionally, this study indicated there were significant relationships between positive urine cultures and factors such as irregularity in bladder emptying and Diabetes Mellitus as well as a history of UTIs . Rahiman et al. (2015) highlighted that ,bladder emptying completely and correctly is one way to prevent UTI's from occurring. In addition, avoiding delaying urination can also help prevent an individual from developing a UTIs. Pregnant women who had diabetes and/or a history of UTIs were more likely to develop it than pregnant women who did not have these issues prior to being pregnant. There is likely an increased amount of glucose in the urine during pregnancy, as well as decreased immune functional abilities, which make it easier for pregnant women to become infected. Elevated levels of blood glucose may also impair neutrophil function by increasing calcium levels present within the cell. Consequently, this may affect how well neutrophils are able to perform such functions as phagocytosis, diapedesis, and actin activity. In addition to insulin autoantibodies, He et al. (2018) has associated random blood glucose levels and 24-hour urinary albumin excretion as being important predictors of UTIs among diabetic patients. His findings also demonstrated that patients who had asymptomatic bacteriuria were much more likely to test positive for urinary cultures than patients who had symptomatic bacteriuria. ($P < 0.001$).

5. Conclusion

In conclusion, the study indicates that while socio-demographic and most obstetric factors are not major determinants of culture positivity, behavioural habits, underlying metabolic disease, previous urinary tract infection, and clinical symptoms play a significant role in predicting infection. These findings emphasize the importance of early screening, health education, and proper management of urinary tract infections during pregnancy to reduce complications and improve maternal outcomes**.**

6. Limitations

There are many limitations to consider when interpreting the findings of this study. First, as the research was carried out in a selection of healthcare settings in Karbala, the results may not be generalizable to all pregnant women in different areas or healthcare institutions. Second, the study had a comparatively small sample size compared to other similar studies, which could compromise the statistical power of the results. Third, since the study's structure was cross-sectional, it cannot be used to ascertain causal relationships among the risk factors associated with urinary tract infections. Fourth, some of the information collected in the study was from participants' own self-reporting of their health symptoms, and can therefore be subject to bias and/or inaccuracy based on the reliability of the participant's memory. Fifth, while most diagnostic techniques used in the study came from a routine microbiological culture method, this study did not benefit from other advanced and/or molecular techniques that might have provided additional diagnostic information about the urinary tract infection etiology.

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8. Conflict of interest statement

The authors declare no conflicts of interest relevant to the content of this review ,No financial relationships, personal interests, or affiliations influenced the research design, analysis, interpretation, or reporting of the findings.

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