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The Prevalence of Urinary Tract Infections and The Agents Responsible for Them in Pregnant Women in the Province of Karbala

Huda Muhanna Redha[1], Basim Jawad Hussein[2], Ali Abbas Sadiq Alqaisi[3], Wisam Kadhim Hamadan[4], Zahraa Hadi Obiad[5], Ali Jalal Abood[6]

[1]Kut technical institute, Department of agricultural biotechnology, D.A.B – Iraq
[2]Ministry of Agricultural- Iraq
[3]Department of Biology- College of Science - Diyala University – Iraq
[4]Department of Chemical - College of Science - Diyala University – Iraq
[5]College of Biotechnology - Al-Qasim Qreen University- Iraq
[6]Ministry of health - Iraq

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ABSTRACT

Objective: *This study aimed to determine the prevalence of urinary tract infections (UTIs) and identify the uropathogens present in pregnant women.* ***Methods:*** *A total of 417 midstream urine samples were collected and examined between December 2021 and August 2022. The diagnosis of UTI was established when a urinary tract pathogen exhibited growth of at least 10510^5105 CFU/ml in culture. Isolated microorganisms were identified using biochemical assays.* ***Results:*** *The findings revealed that 49.4% of the pregnant women had a UTI. Among the isolated organisms, E. coli was the most prevalent (56.79%), followed by Proteus sp. (5.8%), Pseudomonas sp. (6.3%), and Klebsiella sp. (19.9%).* ***Novelty:*** *This study provides updated insights into the prevalence and microbial profile of UTIs among pregnant women, highlighting the dominance of E. coli as the leading uropathogen during pregnancy.*

INTRODUCTION

In community practice, urinary tract infections (UTIs) rank second in frequency of infection. Women are more likely than males to get a UTI; between 40% and 50% of them will experience at least one clinical episode in their lives [1]. Pregnancy, a small urethra, the lack of prostatic secretions, and the ease with which faecal bacteria might contaminate the urinary system are all potential risk factors for urinary tract infections in women [2]. Ureteral dilatation occurs in around 90% of pregnant women and lasts till birth [3]. Additionally, it could be a factor in ureterovesical reflux and increased urine stasis. Additionally, up to 70% of pregnant women have glycosuria, which is thought to promote bacterial growth in the urine, and the natural increase in plasma volume during pregnancy lowers urine concentration [3], [4]. Consequently, pyelonephritis is the most frequent serious bacterial infection that complicates pregnancy, with urinary tract infections (UTIs) being the most prevalent kind of infection during pregnancy. In the second part of pregnancy, 1% to 4% of pregnant women may suffer acute cystitis, 1% to 2% will develop severe acute pyelonephritis, and 4% to 10% will have asymptomatic bacteriuria (ASB) [5].

Pregnancy-related UTIs are more likely to occur in women with a history of the condition. Other risk factors include worse personal hygiene, anemia and sickle cell trait, greater parity or age, and inadequate prenatal care. Functional urinary tract abnormalities and diabetes mellitus may further heighten a woman's vulnerability to urinary tract infections (UTTIs) during pregnancy [6]. Preterm labor and/or low birth weight are doubled by ASB, and infections, especially in the elderly and during pregnancy, might be asymptomatic. If a UTI is left untreated during pregnancy, there is an increased risk of pyelonephritis, early delivery, and fetal fatality by 20% to 40%. The risk of embryonic mortality and mental impairment or developmental delay is increased when a third trimester UTI occurs [6].

Enterobacteriaceae family members are the most often found pathogens, accounting for 84.3% of UTIs [7]. The same microorganisms that cause UTIs in non-pregnant individuals also cause them in pregnant women. Approximately 85% of community-acquired UTIs, 50% of nosocomial UTIs, and more than 80% of cases of uncomplicated pyelonephritis are caused by E. Coli [8], [9].

These E. Coli may be endogenous colon flora that colonize the vaginal introitus and periurethral region before ascending to the bladder and the renal pelvis through a process controlled by receptors. Both host and bacterial components, including as tissue receptors and the production of bacterial attachment proteins, are involved in the process [10]. A specific injury to the kidney epithelium is induced by a vacuolating cytotoxin that is produced by uropathogenic E. coli [11]. 6% to 17% of all nosocomial UTIs are caused by the medically equally significant enterobacteria-ceae species Klebsiella, which has an even greater prevalence in certain patient populations that are at risk [12].

Proteus mirabilis is frequently the cause of urinary tract infections (UTTIs) in those who have difficult UTIs or long-term urinary catheter users. Even though P. mirabilis is sensitive to antibiotics, treating it with them might be challenging. Antibiotic therapy has been hypothesised to protect microorganisms found in a stone matrix [13]. Certain less common forms of bacteria can cause UTIs [14].

The expression of many types of receptors in the urinary system as a result of physiological, hormonal, and structural changes during pregnancy increases the specificity of infection. Untreated asymptomatic bacteriuria has been shown to raise the risk of low birth weight and early delivery [15], as well as having a 20% to 30% chance of causing acute pyelonephritis [14], [16], [17]. In order to prevent these consequences, it is crucial to detect UTI infections with intensive screening and treatment for ASB throughout pregnancy. The identification and incidence of UTI in pregnant women in the southern and northern regions of Karnataka, South India, are the main subjects of this study. It also emphasizes the prevalence and kinds of etiological agents at various times of pregnancy.

417 urine samples total from women at varying stages of pregnancy were taken. All of the chemicals and reagents needed for the culture medium were purchased from Karbala's central medical laboratory.

RESEARCH METHOD

1. Microscopic Study

The study included urine samples with more than 10 pus cells and a high power field (40×) in order to meet one of the diagnostic criteria for urinary tract infections.

2. Isolation and Identification of Uropathogens

Using a calibrated loop and semiquantitative urine culture, bacterial pathogens were isolated on nutrient agar plates. Isolated colonies were grown on differential media, such as MacConkey's agar and blood agar, to further characterize them based on cultural traits [18]. As to Kass's [19] guidelines, isolate a single bacterial species at a concentration of greater than 105 colony-forming units (CFU) from a urine sample in order to differentiate a true infection from contamination. The analysis only included a single positive culture per subject.

In situations where there was no growth, the plates were incubated at 37˚C for 24 hours and then left for a further 48 hours. Additionally, the isolates were identified using biochemical, morphological, and cultural testing. According to Cheesbrough [20,21], the processes utilized in the identification and characterization of the isolated bacteria included Gram staining, the motility test, and biochemical assays including TSI and IMViC. After being identified and isolated, the uropathogens were kept at -20˚C in nutritional broth with 25% glycerol.

RESULTS AND DISCUSSION

Result

206 of the 417 urine samples that were analyzed in this research had substantial bacteriuria. Upon high power (40×) field microscopy, more than 10 pus cells were seen. 49.4% of pregnant women were found to have a UTI overall.

Women in the age categories of 21–25 and 36–40 years old exhibited the greatest incidence (53%) of UTI, respectively. The overall incidence of UTI varied from 44% to 53% according to age (Table 1).

Table 1. Incidence of UTI in relation to age distribution in pregnant women.

Age group (Years)	No: tested	(%)	No: positive (%)	No: negative (%)
18-20	61	(14.3%)	28 (48.3%)	30 (51.6%)
21-25	131	(31.17%)	70 (53%)	62 (46.9%)
26-30	150	(36.45%)	73 (47.3%)	81 (52.6%)
31-35	44	(10.79%)	20 (44.3%)	23 (55.5%)
36-40	31	(7.19%)	15 (53.3%)	15 (46.6%)
Total	417(100%)		206(49.4%)	211(50.5%)

Pregnant women had the highest incidence of UTI (54.8%) in their third pregnancy and beyond, followed by their first pregnancy (48.4%), and their second pregnancy (43.3%), which had the lowest incidence of UTI (Table 2).

Table 2. Incidence of UTI by parity (no: of pregnancy).

No: of Parity	No: tested	No: positive (%)
First pregnancy	191	91 (48.4%)
Second pregnancy	92	38 (43.3%)
Third pregnancy and above	134	76 (54.8%)
Total	417	206 (49.4%)

According to gestational age, or the age at which a pregnancy begins, the frequency of UTI is highest in the seventh month (70.2%), highest in the third month (25%) and lowest in the fifth (29%) (Table 3).

Table 3. Incidence of UTI by gestational age (age of preg-nancy).

Age of pregnancy (months)	No: tested	No: positive (%)
3	13	3 (25%)
4	21	13 (54.5%)
5	57	16 (29.3%)
6	73	38 (51.3%)
7	75	51 (70.2%)
8	121	57 (47.5%)
9	57	28 (47.3%)
Total	417	206 (49.4%)

Table 4 illustrates the incidence of UTI by trimester and shows that women had a higher incidence of UTI cases in their second and third trimesters (54.1% and 43.3%, respectively) compared to their first trimester (25%).

Table 4. Incidence of UTI by trimester period.

Trimester period	No: tested	No: positive (%)
I trimester (1st 3 months)	13	4 (25%)
II trimester (2nd 3 months)	150	64 (42.4%)
III trimester (3rd 3 months)	254	138 (55.15%)
Total	417	206 (49.4%)

Of the 206 bacterial isolates isolated from 417 urine samples, the majority (99%) were Gram-negative bacteria, with Escherichia coli accounting for 56.79% of the isolates. Enterobacter sps (3.8%), Citrobacter sps (1.4%), Enterococcus sps (0.9%), Pseudomonas

sps (6.3%), Proteus sps (5.8%), Klebsiella sps (19.9%), and other NFGNB (4.8%) as Table 5 illustrates.

Table 5. Frequency of bacteria isolated from pregnant women with UTI.

Isolates	No: of positive samples (%)	
Escherichia coli	118	(56.82%)
Klebsiella species	40	(19.4%)
Pseudomonas species	12	(5,8%)
Proteus species	13	(6,3%)
Enterobacter	8	(3.8%)
Citrobacter	2	(0.3%)
Enterococcus species	3	(1.4%)
NFGNB	11	(4,8%)
Total	206	(49,4%)

It was discovered that there was a similar correlation between the age of pregnant women and the frequency of isolation of various species (Tables 6 and 7).

Table 6. Incidence of bacterial isolates in different trimester period.

Trim-ester	No positive	E. coli (%)	Klebisella sps (%)	Pseudomonas sps (%)	Proteus sps (%)	Enterobacter sps (%)	Citrobacter sps (%)	Enterococcus sps (%)	NFGNB (%)
I	3	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
II	67	34(50)	15 (22)	4 (7.5)	6 (7.5)	2 (4.5)	2 (3.0)	0	5 (12.1)
III	138	82 (59.1)	26 (19.80)	7 (5.8)	8 (5.1)	4 (3.6)	1 (0.7)	2 (1.4)	5 (4.3)
Total	208	119 (56.7)	41 (19.85)	11 (6.3)	14 (5.8)	6 (3.8)	3 (1.4)	2 (0.9)	10 (4.8)

Table 7. Frequency of bacterial isolates in UTI cases in relation to month of pregnancy.

Month	No positive	E. coli (%)	Klebisella (%)	Pseudomonas (%)	Proteus (%)	Enterobacter (%)	Citrobacter (%)	Enterococcus (%)	NFGNB (%)
3	3	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	13	7(50)	3 (16.6)	0 (0)	2 (16.6)	0 (0)	1 (8.8)	0 (0)	1 (8.3)
5	16	8 (52.9)	2 (17.64)	2 (5.8)	0 (0)	2 (5.8)	1 (5.7)	0 (0)	2 (11.74)

6	36	17 (48.6)	8 (24.38)	3 (10.8)	4 (10.8)	1 (5.4)	0 (0)	0 (0)	0 (0)
7	53	32 (59.5)	9 (15.32)	4 (5.8)	3 (5.7)	2 (1.9)	1 (1.9)	1 (1.9)	4 (7.8)
8	57	35 (64.8)	12 (22.2)	3 (6.7)	2 (3.4)	1 (3.4)	0 (0)	1 (1.7)	0 (0)
9	28	15 (51.2)	7 (22.4)	1 (3.7)	1 (3.7)	2 (7.4)	0 (0)	0 (0)	3 (11.11)
Total	206	117 (56.7)	41 (19.90)	13 (6.3)	12 (5.8)	8 (3.8)	3 (1.4)	2 (0.9)	10 (4.8)

Discussion

Symptomatic or asymptomatic bacteremia is common during pregnancy. Acute pyelonephritis will result from 20% to 30% of asymptomatic bacteruria if treatment is not received. This poses a major risk to the mother and fetus since it can lead to low birth weight babies, early delivery situations, and sometimes, stillbirth [22]. Pregnancy-related UTIs may raise the chance of mental impairment or cerebral disability. As a result, it becomes essential to closely monitor UTI infections in pregnant women [6].

Because pregnant women excrete more amino acids, vitamins, and other substances in their urine, which promote the infection's persistence, they are more likely to get a UTI [23]. Pregnant women have a physiological increase in plasma volume that lowers urine concentration. Additionally, the majority of pregnant women (70%) experience glycosuria, which is thought to promote bacterial growth in urine [3]. Furthermore, several defense systems of the mother become less efficient during pregnancy [24].

The research population's 49.4% incidence rate of UTIs in pregnant women is almost identical to data by Okonko et al. [25] in Nigeria, where they reported a 47.5% incidence rate in pregnant women. Nonetheless, reports indicate that other nations, such as 38% in Iran, 28.5% in Pakistan, 14.2% in Saudi Arabia, 10.6% in Turkey, and 30% from Yemen, have somewhat lower incidence rates of UTI [26].

The results of this study are lower than the incidence rates of 58% and 71.6% found in two separate Nigerian towns where pregnant women participated in a comparable study [27, 28]. This might be brought on by inadequate environmental and personal hygiene, a low socioeconomic position, or a lack of knowledge about health care. India has reported varying rates of urinary tract infections (UTTIs) among non-pregnant women: 10.8% in Aligarh [29], 16.3% in Tamilnadu [30], and 40.4% in Imphal, Manipur [31].

Additionally, this study demonstrates that a high incidence rate of 54.8% of women with UTIs were in their third trimester or later. According to our findings about the incidence of UTI by parity, women who were pregnant for their third pregnancy or more had a higher incidence. With the exception of the first pregnancy, our findings are very identical to those from Nigeria as reported by Okonko 2009 [25]. Parity is thus one of the potential variables influencing the prevalence and incidence of UTI in expectant mothers.

It is anticipated that the third trimester would have the highest prevalence of UTIs rather than the second and first trimesters due to growing blockage of the urinary system. In comparison to studies from Nigeria (42.5%) [25], this study indicates a much lower incidence of UTI among women in their first trimester (25%) [26]. However, it is slightly higher than data from Yemen (17.1%) [26]. The study's second- and third-trimester UTI incidence rates (43.3%) and 54.15%, respectively, are comparable to reports from Okonko [25] in Nigeria, while Al Haddad [6] reported lower incidence rates of 34.1% and 48.8%, respectively. According to past studies and our personal findings, pregnant women experience more than 50% of their UTIs between the sixth and

Regarding the age of infection, gestation, and parity, our findings are consistent with those of the other investigations [25], [26]. Pregnant women are more likely to have a UTI when their parity, age, and gestational age are increased.

Urine samples from pregnant women were used to isolate Enterobacteriaceae, a family of Gram-negative bacteria. Comparing our study's 56.79% prevalence of uropathogens to the most often isolated organisms in Britain (65.1%) and two US studies conducted in 2001 by Sahm et al. [32], Escherichia coli was found to be the most common. This result is consistent with recent results that indicate the most prevalent pathogens recovered from UTI patients are gram negative bacteria, especially E. coli [27], [33].

Comparing our study's E. Coli incidence to Nigerian studies that reported 42.10% [25] and 51% [34], we found that ours was higher. Less than 50% of E. coli isolates from UTI patients were found in the majority of studies done in Africa and the Arab world. However, S. aureus isolates from UTI cases more frequently—29%—than E. coli. According to reports from other industrialized and developing nations, less than 10% of uropathogens are identified as Gram positive bacteria [29], [30], [31]. The fact that no single species of S aureus was recovered in this investigation is noteworthy; yet, less than 1% of uropathogens are related to Enterococci sps.

In our investigation, Klebsiella species (19.9%), Pseudomonas species (6.3%), and Proteus species (5.8%) were the most frequently isolated uropathogens. This study was comparable to others [35], [36], [37], [38], [39]. Additional pathogens that were identified included Enterococcus sps (0.9%), Citrobacter (1.4%), Enterobacter (3.8%), and NFGNB (4.8%). A research conducted in Aurangabad, however, revealed that Klebsiella was the most often occurring isolate, followed by Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus [40].

With a few small exceptions, our findings are consistent with reports from researchers in other nations. These variations might be attributed to variations in the surrounding environment, community social customs, staff cleanliness standards, and health care delivery [41], [42], [43].

CONCLUSION

Fundamental Finding : The study identifies a higher UTI prevalence (49.4%) in symptomatic pregnant women, with E. Coli being the most common pathogen. The third

trimester, particularly the seventh month, exhibited the highest infection rates, highlighting susceptibility linked to age, parity, hygiene, and socioeconomic factors. **Implication :** These findings underscore the urgent need for improved UTI prevention strategies and enhanced public awareness campaigns focused on hygiene and health practices during pregnancy to reduce risks to both mother and fetus. **Limitation :** The study's limitation lies in sampling exclusively symptomatic pregnant women, potentially overestimating the overall prevalence and limiting generalizability to all pregnant populations. **Future Research :** Future studies should explore broader populations, including asymptomatic cases, and investigate targeted interventions to mitigate UTI risks during pregnancy across diverse socioeconomic and demographic contexts.

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***Huda Muhanna Redha (Corresponding Author)**
Kut technical institute, Department of agricultural biotechnology, D.A.B – Iraq

Basim Jawad Hussein
Ministry of Agricultural- Iraq

Ali Abbas Sadiq Alqaisi
Department of Biology- College of Science - Diyala University – Iraq

Wisam Kadhim Hamadan
Department of Chemical - College of Science - Diyala University – Iraq

Zahraa Hadi Obiad
College of Biotechnology - Al-Qasim Qreen University- Iraq

Ali Jalal Abood
Ministry of health - Iraq