

Original Article**Bacteriological Study of Urinary Tract Infections among Pregnant Women in Al Samawa City of Iraq****Nahab, H. M¹*, Akeel Hamed Al-Oebady, M¹, Aqeel Abdul Munem, H¹***1. Department of Biology, College of Science, Al-Muthanna University, Samawah, Iraq*

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Abstract

Pregnancy causes some changes in pregnant women due to mechanical and hormonal changes that lead to ureteral dilatation and urinary stasis which in turn contribute to an increased risk of developing urinary tract infection (UTI). This study aimed to determine the frequency of urinary tract infections among pregnant women in Samawa city, Iraq, and examine the isolated organisms. In total, 210 and 55 urine samples were collected from pregnant and non-pregnant women with clinical signs and symptoms of UTI who were hospitalized in the Obstetric and Pediatric Hospital in Samawa, Iraq, respectively. The data collected from each woman included their age, gestational period, parity, level of education, and residence. The frequency of urinary tract infections among the studied woman was 86%. *Escherichia coli* (38.6%), *staphylococcus aureus* (20.4%), and *Proteus mirabilis* (12.7%) were the most frequently isolated bacteria in the current study. According to the recorded data in this study, 86% of the infections in pregnant women occurred in the age group of 25-34 years (52.4%) and the 3rd trimester of pregnancy (49.1%). On the other hand, the results revealed that the infection rate in women with one to three pregnancies was 50.2% more than non-pregnant women. The findings of the current study showed that the highest rate of infection was observed in women who were in the age range of 25-34 years (52.4%). This can be explained by the fact that women often experience the highest reproductive activity during this period. In fact, in this period of life, women are most prone to sexual activity which predisposes them to the introduction of microorganisms to the urinary tract which causes infection. The recorded data showed that UTI became more prevalent with the progress of pregnancy, accounting for 49.1% of infections occurring in the third trimester of pregnancy. Parity and frequent pregnancies are other factors that account for 50.2% of UTI. The prevalence of UTI in women with 1 to 3 children was 58.5%. Moreover, the rate of UTI was 61.3% among pregnant women who attended the antenatal care unit, which was the highest risk of UTI among the pregnant participants. In the non-pregnant women, the prevalence of UTI was 50.2 at the age range of 6-12 years. Based on the obtained results, pregnant women were more vulnerable to renal infection. On the other hand, the concurrence of UTI was positively influenced by sexual activity and pregnancy.

Keywords: Bacterial isolates, Gram-negative bacteria, Pregnancy, Urinary tract infection**1. Introduction**

Urinary tract infection (UTI) may be defined as an infection caused by the presence of microorganisms anywhere in the urinary tract (1). In the first years of life, signs and symptoms of UTI are nonspecific and vague. However, if untreated, such infections can lead to renal scarring which is a risk factor for end-stage renal disease (2). It should be noted that UTI affects

people of all ages; however, women are more vulnerable to the infection, compared to men, due to a shorter urethra, absence of prostatic secretion, pregnancy, and easy contamination by fecal flora in the urinary tract (3). Bacteria causing urinary tract infections have developed a high level of antibiotic resistance. Antibiotic resistance leads to some difficulties in the treatment of UTI by increasing

patient morbidity, re-treatment costs, re-evaluation, length of hospitalization, and use of broad-spectrum antibiotics. A population of microorganisms may lose their susceptibility to an antibiotic while the patient is being treated (4). During pregnancy, the microorganisms responsible for UTIs are the same as those responsible for UTIs in non-pregnant patients. *Escherichia coli* (*E. coli*) is responsible for 70-80% of infections (5, 6). Other common Gram-negative bacteria (GNB) include *Proteus mirabilis* and *Klebsiella sp.* However, Gram-positive cocci, such as group-B streptococci, *Staphylococcus sp.*, *Gardnerella vaginalis*, *Ureaplasmaurealyticum*, and *Mycoplasma hominis* are not common (7). Anaerobic microorganisms and other fastidious pathogens have been detected in the urine of a large percentage of pregnant women; however, the significance of the microorganisms isolated from the urine and perinatal outcomes are still unknown. In the pregnancy period, the women are more prone to UTI, partly due to the pressure of the gravid uterus on the bladder which causes stasis of urine flow as well as some hormonal and immunological changes in normal pregnancy (8, 9). Therefore, pregnant women should have a routine urine checkup during pregnancy (10). This study aimed to investigate the most common virulence microorganisms that cause UTI in pregnant women and assess the relationship between UTI and such factors as age, and pregnancy period.

2. Materials and Methods

2.1. Patients and Sampling

In total, 210 and 55 urine samples were collected from pregnant and non-pregnant women with clinical signs and symptoms of UTI who were hospitalized in the Obstetric and Pediatric Hospital in Samawa, Iraq. Samples were transferred to the laboratory to isolate the bacteria under cool conditions. The present study was conducted in the Iraqi province of Al-Muthanna from August 2018 to March 2019. In this study, urine samples were collected in sterile screw-capped containers using the recommended clean-catch

midstream method (11). All the samples were then cultured on nutrient agar, blood agar, MacConkey Agar, and Sabouraud Dextrose Agar using a sterile standard loop (0.001 ml) and incubated at 37°C for 24 h. The face-to-face interviews with pregnant women yielded data on age, parity, gravidity, educational level, pregnancy period, residence, employment, and the total number of pregnancies. Microscopically, the urine samples were examined after centrifugation to detect pus, epithelial, and red blood cells, crystals, and yeast.

2.2. Sample Isolation and Identification

All urine samples were individually identified, and all the observations were recorded as well. Pure bacterial isolates were examined for cell morphology using Gram stain, and the standard biochemical tests (i.e., TSI, IMVIC, Gelatin liquefaction test, fermentation of sugar using API 20 E, API 20 C AUX, and API STAPH systems) were performed, according to Faddin (12). Gram-positive bacterial isolates were identified using Coagulase, Catalase, and Oxidase tests, and *S. aureus* isolates were identified using Mannitol Salt Agar. A germ tube test was used along with CHROM agar to detect *Candida albicans*.

2.3. Statistical Analysis

The recorded data were analyzed using the Chi-square test which examined the relationship between UTI and multiple factors presented by the numbers, percentages, and graphs. *P*-values less than 0.05 were considered statistically significant.

3. Results and Discussion

According to the recorded data and the total 265 samples in the current study, it was revealed that 210 pregnant and 55 non-pregnant (controls) women were suspected of UTI, indicating that pregnant women were more affected by UTI, compared to non-pregnant women. Moreover, out of 210 pregnant women, 181 (86%) women were affected by UTI, while 15 (27%) out of 55 non-pregnant women were infected by UTI. This can be explained by the fact that pregnant women with increased reproductive activity are most prone to the introduction of the microorganism to the urinary tract that causes

infection (13). The positive isolated pathogens responsible for UTI showed that the proportion of GNB (69.06%) was higher than Gram-positive pathogens (28.17%) and *Candida albicans* (2.77%) (Figure 1). As indicated in table 1, *E. coli* was the most common isolate (n=69, 38.1%) obtained from pregnant women with UTI, followed by *Staphylococcus aureus* (*S. aureus*) (n=37, 20.4%) at the next place. The obtained results revealed that in non-pregnant women *S. aureus* (n=9, 60%), *E. coli* (n=4, 26.6%), and *S. epidermidis* (n=2, 13.3%) were the most common isolates collected from infected women with UTI signs and symptoms (Table 2).

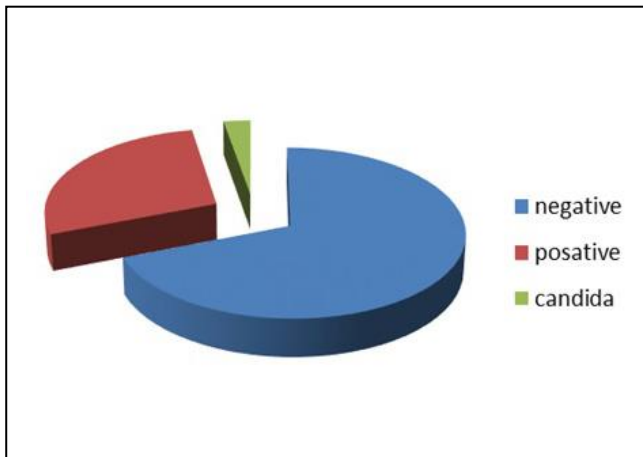


Figure 1. Isolated pathogens of UTI collected from pregnant women

Table 1. Bacterial isolates of UTI in pregnant women (n=181)

Bacterial Pathogens	No.	Percentage (%)
<i>Escherichia coli</i>	70	38.1
<i>Staphylococcus aureus</i>	37	20.4
<i>Proteus mirabilis</i>	23	12.7
<i>Pseudomonas aeruginosa</i>	16	8.8
<i>Klebsiella pneumonia</i>	9	4.9
<i>Enterobacteraerogenes</i>	5	2.7
<i>Staphylococcus epidermidis</i>	5	2.7
<i>Staphylococcus saprophyticus</i>	2	1.1
<i>Staphylococcus hemolyticus</i>	3	1.6
<i>Candida albicans</i>	5	2.7
<i>Neisseria gonorrhoeae</i>	2	1.1
<i>Streptococcus spp.</i>	4	2.2
Total	181	100

Table 2. Bacterial isolates of UTI in non-pregnant women (controls) (n=15)

Bacterial pathogens	No.	Percentage (%)
<i>S. aureus</i>	9	60
<i>E. coli</i>	4	26.6
<i>S. epidermidis</i>	2	13.3
Total	15	100

Identification of the bacterial isolates depended on using different diagnosis methods, different culture media, and CHROM-agar media in addition to the biochemical and analytical profile index test (Figure 2).

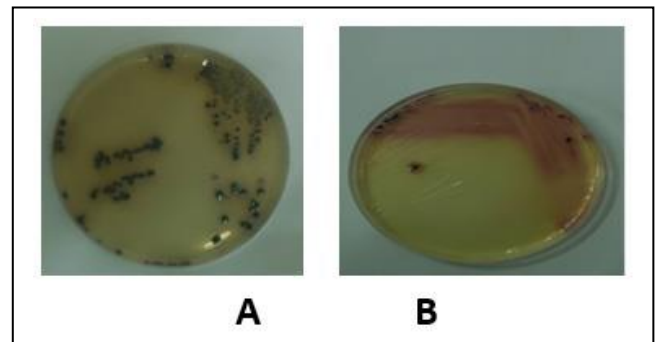


Figure 2. A: CHROMagar *E. coli*. B: CHROMagar *Staph aureus*

Recent sexual activity was considered to be the most important risk factor for UTI in young women, according to Scholes, Hooton (14) and confirmed by Foxman, Gillespie (15). In this study, *E. coli* was the most prevalent pathogenic microorganism. These findings are in line with the results of a study conducted by Al-nasrawi A (16), who explained that *E. coli* was the uropathogen that causes UTI. This finding confirmed the reports of females with UTI in other cities of Iraq, such as Al- Mosul (17), Baghdad (18), as well as those in other countries, such as the USA (19), and Ethiopia (20). *Staphylococcus species* is an opportunistic pathogen that causes infection or disease when the bacterial strains move from the skin to the urinary system (21). *S. aureus* is an actual pathogen since it possesses many virulence factors, including

protein A, toxins, and microcapsule in some strains which enable it to bind to host tissue and cause UTI (22). *S.aureus* was the second most common pathogen responsible for UTIs in young women. *S. saprophyticus*, coagulase-negative cocci, was the second most commonly isolated uropathogenic bacteria (15), and group B haemolytic streptococci were less prevalent, though still clinically meaningful. *Chlamydia spp.* and fungal infections, such as *Candida albicans*, are examples of nonbacterial causes. *Enterobacteriaceae* often spread from the rectum or vagina to the urethra, bladder, or even kidneys. The bacterial causes of UTI in pregnancy essentially mirror those in non-pregnant patients. *Proteus*, *Klebsiella*, and most *Enterobacteriaceae* species show high urease activity and form urinary calculus, which can represent reservoirs of inflammation (23).

The obtained results in the current study showed that the highest rate of infection occurred in the age group of 25-34 years (52.4%). This can be explained by the fact that women's reproductive activity increases during this period; therefore, they are most prone to sexual activity which predisposes them to the introduction of microorganisms to the urinary tract and infection (10) (Figure 3).

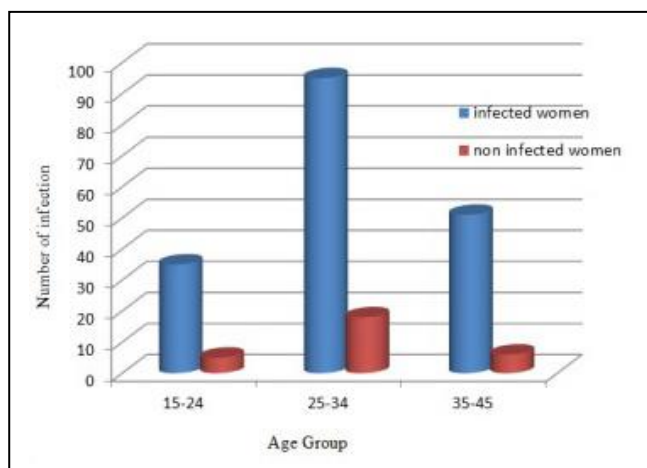


Figure 3. Relationship between age group and the number of infections

Figure 4 presents the prevalence of UTI among pregnant women in pregnancy trimesters. Bacteria became more prevalent with the progress of pregnancy, accounting for 49.1% of infections in the third trimester of pregnancy.

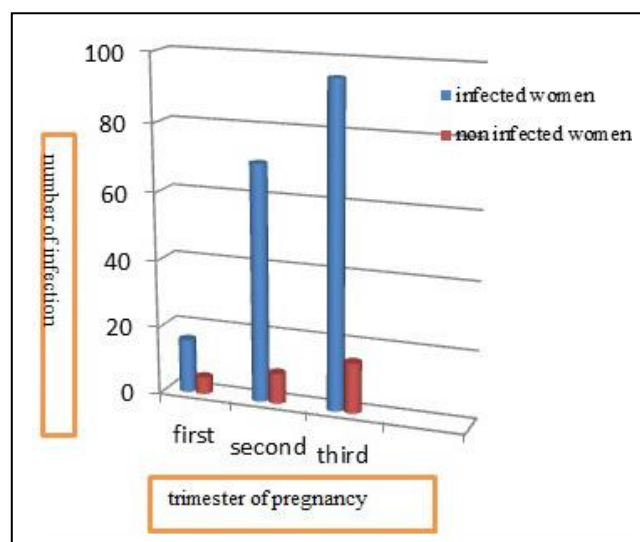


Figure 4. Relationship between trimesters of pregnancy with the number of infections

The microscopic examination of urine sediment was conducted using centrifugation at 3000 rpm for 5 min (e.g., pus cells, bacterial cells, red blood cells, and epithelial cells) among infected women (Table 3).

The obtained results revealed that 86% of UTI were observed in pregnant women. On the other hand, the results of the current study showed that women's age could be considered the most important factor associated with the rate of UTI. The participants in the current study were in the age range of 25-34 years, and the rate of UTI was 52.4% among them. On the other hand, the progression of pregnancy was one of the most important factors in the prevalence of UTI. The findings of this study revealed that the prevalence of UTI in the 3rd trimester of pregnancy was 49.1%. Other features, such as parity and frequent pregnancies accounted for 50.2% of UTI. The prevalence of UTI was 58.5% among women with 1 to 3 children. The rate of UTI was 61.3% among all pregnant women who attended the antenatal care unit, which was the highest risk of UTI among pregnant women in this study. The

prevalence of UTI was 50.2% at the age range of 6-12 years among non-pregnant women.

Table 3. Distribution of microscopic urinalysis among infected women (n=181)

Variable	No.	%
Bacteria seen	55	30.3
Crystals	30	16.5
Pus cells	41	22.6
Protein	7	3.8
Red Blood Cells	6	3.3
Epithelial cell	3	1.6

Based on the obtained results in the current study, pregnant women are more vulnerable to having a renal infection. Moreover, the concurrence of UTI was proved to be positively influenced by sexual activity and pregnancy in women.

Authors' Contribution

Study concept and design: H. M. N.

Acquisition of data: H. A. A. M.

Analysis and interpretation of data: M. A. H. A. M.

Drafting of the manuscript: H. M. N.

Critical revision of the manuscript for important intellectual content: H. M. N.

Statistical analysis: H. M. N.

Administrative, technical, and material support: H. M. N.

Ethics

All studies were performed in compliance with the rules of the human ethics of the Al-Muthanna University, Samawah, Iraq.

Conflict of Interest

The authors declare that they have no conflict of interest.

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