

Research article

High Incidence of *Escherichia coli* – Urinary Tract Infection in Pregnant Women in Iraq

Hanaa Jabbar Rasheed^{1*}, Khairi Jameel Al-Ruaby¹, Alwan Abed Hamadi AlQshawi²

ABSTRACT

Escherichia coli is considered as one of the most important microbial causes of urinary tract infections (UTIs) in women. The UTI caused by *E. coli* increased in the last years and the resistance strains to wide spectrum also increased with time. The present study aims to evaluate the incidence of *E. coli* that is responsible for UTI in women and evaluate the difference between pregnant and non-pregnant women in Iraq. The urine samples were collected from 170 women who visited the public hospital in Wasit City. The clinical cases were divided into symptomatic cases and asymptomatic cases. *E. coli* was identified by using the biochemical test, API20E system, and Vitek II System. The Bergy's Manual of Systematic Bacteriology was followed to identify the species of *E. coli*. The current study showed that the highest percentage of UTI infection with *E. coli* as seen in symptomatic women aged 25-29 years old, and the highest percentage of asymptomatic UTI infection in women aged range 25-29 years. The highest percentage of UTI infection with *E. coli* was seen in pregnant women as compared with non-pregnant women ($P < 0.05$, Chi-square). It can be concluded that the incidence of *E. coli*-UTI is high in women in Iraq and the incidence of *E. coli*-UTI in pregnant women is higher than the incidence of *E. coli*-UTI in non-pregnant women.

Keywords: API20E system, *Escherichia coli*, Biochemical test, Vitek II System, Urinary tract infection.

Citation: Rasheed HJ, Al-Ruaby KJ, AlQshawi AAH. (2022) High incidence of *Escherichia coli* – urinary tract infection in pregnant women in Iraq. *World J Exp Biosci* 10: 42-44.

Received July 19, 2022; Accepted October 3, 2022; Published October 19, 2022.

1. INTRODUCTION

Urinary tract infections (UTIs) are widespread and affect a large proportion of the human population, About 150 million people worldwide develop UTIs each year, with high social costs [1]. UTIs are some of the most common bacterial infections in women [2]. UTIs are classified in order of severity such as urosepsis syndrome, pyelonephritis, and cystitis [3]. *E. coli* and *Staphylococcus saprophyticus* are responsible for 80% of community-acquired uncomplicated urinary infections (UTIs), particularly in women under 50 years of age [4]. Uropathogenic *E. coli* differs from intestinal pathogenic *E. coli* with regard to the presence of specific virulence factors [2]. β -Lactams such as ampicillin inhibits bacteria cell wall synthesis. Despite the great progress in antimicrobial development, many infectious disease

especially intracellular infections, remain difficult to treat [5]. *E. coli* is intrinsically susceptible to almost all clinically relevant antimicrobial agents, but this bacterial species has a great capacity to accumulate resistance genes, mostly through horizontal gene transfer [6]. The most problematic mechanisms in *E. coli* correspond to the acquisition of genes coding for extended-spectrum β -lactamases, and carbapenemases [7]. Asymptomatic bacteriuria is more prevalent than symptomatic among pregnant women, with *Escherichia coli* being the most prevalent causative organism and showing a multi-drug resistance pattern, therefore, it is recommended that urine culture be conducted for screening and diagnosis purposes for all pregnant women [8]. The prevalence of urinary tract infection

* Correspondence: Hanaa Jabbar Rasheed. E. mail: Hano.Bio@yahoo.com
Department of Biology, College of Science, University of Wasit, Wasit, Iraq.
Full list of author information is available at the end of the article.

Copyright: © Rasheed HJ, Al-Ruaby KJ, AlQshawi AAH. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any site, provided the original author and source are credited.

among pregnant women was 55.0% and significantly affected by gestational age and parity [9].

The objective of the present study is to focus on the isolation and characterization of *E. coli* isolated from UTIs in women and study the incidence of the infection of *E. coli* in pregnant women in Iraq.

2. MATERIAL AND METHODS

A hundred seventy urine samples were collected from pregnant female patients suffering from urinary tract infections (UTIs). Fifty healthy volunteers were used as a control group. The patients' cases were examined by the urologist. All cases were outdoor cases. Hundred samples were collected from symptomatic women with UTI and seventy samples were collected from asymptomatic women. The samples were collected from women whom attended to Al-Kut Hospital for Gynecology and obstetrics and pediatrics during the period from October, 2021 to April, 2022. The urine samples were collected aseptically in a sterile container and transferred directly to the lab for microbiological study. The urine samples were inoculated onto McConkey agar and eosin methylene blue (EMB) agar. Colonies appeared as bright pink colonies when cultured on MacConkey agar and the colonies appeared green metallic sheen on EMB media. The identification of the isolate was dependent on morphological and biochemical tests, the Bergy's Manual of Systematic Bacteriology [10] was followed in the identification of isolates. For confirming the species of isolates the API20E system [11] and Vitek II System (VITEK® 2: Healthcare | bioMérieux) [11]. The isolates were preserved for a short time by streaking the isolates onto nutrient agar slant incubated at 37 °C for 18 h and then stored at 4 °C. The nutrient broth (20 % glycerol, Sigma-Aldrich) was inoculated with identified isolates and incubated at 37 °C for 18 h and then stored at -20 °C for a year (long-term preservation).

3. RESULTS AND DISCUSSION

The present study showed the high incidence of infection with *E. coli* in women. The *E. coli* was isolated from 41.1 % of patients, and 6.4 % of cases was infected with *Klebsiella pneumonia* and 5.3% was infected with *Pseudomonas aeruginosa*. The present study showed the high incidence of *E. coli* infection in UTI women in Iraq. Several previous studies showed that the high percentage of infection with *E. coli* in women, Moreno et al. (2008) showed the high incidence of infection with *E. coli* especially in women [11]. Previous study of demonstrate that the relationship between *E. coli* virulence and the severity of urinary tract infection is analogous to that previously observed in pediatric populations and also illustrate the balance between host resistance and bacterial virulence in the urinary tract especially in women [12].

Table 1 showed the age distribution of the infection with *E. coli* that associated with UTI in Iraqi women. The highest percentage of *E. coli*-UTI in symptomatic Iraqi women (the patients appear the clinical symptoms of UTI) was observed in the age range of 25-29 years old. While the highest percentage of incidence with *E. coli*-UTI in asymptomatic remarks (not showing any clinical symptoms of UTI) was observed in patients who aged rang 20-24 years old. From what has been shown, it can be judged that the highest rate of urinary tract infection occurs in young and mature women between 20 and 30 years of age. This is due to the fact that this stage of life is considered the stage most associated with pregnancy and problems that are reflected in UTI [14].

Table 1. Distribution of *E. coli* infected cases according to the presence of clinical features of UTI.

| Age | Symptom-atic Samples | <i>E. coli</i> Isolates | Asymptom-atic Samples | <i>E. coli</i> Isolates | Total Isolates |
|---------|----------------------|-------------------------|-----------------------|-------------------------|----------------|
| 15-19 | 16 | 5 (31.25) | 11 | 2 (18.18) | 7 |
| 20-24 | 23 | 10 (43.47) | 18 | 13 (72.22) | 16 |
| 25-29 | 40 | 20 (50) | 30 | 6(20) | 33 |
| 30-34 | 12 | 6(50) | 8 | 2(25) | 8 |
| 35-39 | 8 | 4(50) | 6 | 1(16.66) | 5 |
| 40-45 | 2 | 0(0) | 2 | 1(50) | 1 |
| Total | 101(57.3%) | 45(64%) | 75(42.6%) | 25(36%) | 70 (57.8%) |
| X2 | | 3.48 | | 17.03 | |
| P valve | | 0.626 | | 0.004* | |

Urinary tract infections (UTIs) caused by *E. coli* are more common in women than in men for several reasons. The Women have a shorter urethra than men, which makes it easier for bacteria to travel up the urinary tract and reach the bladder. The shorter distance allows for easier access to the bladder, where the infection often starts. The female urethra is closer to the anus, which can increase the risk of contamination with *E. coli* and other bacteria from the gastrointestinal tract. This proximity makes it easier for these bacteria to enter the urinary tract [15]. Hormonal changes in women, such as those during pregnancy or menopause, can affect the acidity of the vaginal and urinary tract environment. A less acidic environment can provide a more suitable environment for bacterial growth and make women more susceptible to UTIs [16]. Sexual intercourse can introduce bacteria into the urinary tract. This is sometimes referred to as "honeymoon cystitis" and is more common in women who are sexually active. Certain forms of birth control, such as diaphragms and spermicides, can increase the risk of UTIs in women. They may disrupt the balance of bacteria in the vaginal area, making it easier for *E. coli* to colonize the urinary tract. Some hygiene practices, such as wiping from back to front after using the toilet, can introduce bacteria from the anal area to the urethra, increasing the risk of infection [17]. During pregnancy, hormonal changes and the pressure of the growing uterus on the bladder can make women more susceptible to UTIs [14]. It's important to note that while women are more prone to UTIs caused by *E. coli*, men can still get UTIs, and these infections should not be ignored, as they can lead to more serious health problems if left untreated. Prevention strategies, such as good hygiene practices, staying hydrated, and seeking prompt medical treatment when symptoms arise, are crucial for both men and women to reduce the risk of UTIs.

The present study proved that the significant increase ($P < 0.05$) in the incidence of *E. coli*-UTI in pregnant women (28.2 % from total infection, while, the incidence of *E. coli*-UTI in non-pregnant women was 12.9 %. Lain et al. (2011) did the survey of 737 pregnant women found that 5% reported onset of a new infection in the 7 days prior to survey completion, with the most common being a cold/upper respiratory tract infection followed by gastroenteritis, and women pregnant with their first child had a lower rate of self-reported infection than women who had other children, and these results can be used to inform future research examining acute infection as a trigger for pregnancy complications [18].

There are many reasons why UTIs are more common in pregnant women than in non-pregnant women such as changes in anatomy and physiology during pregnancy. The uterus grows and presses on the bladder, making it more difficult to empty completely. This can lead to a buildup of urine in the bladder, which can create a breeding ground for bacteria. Reduced bladder tone, the hormones of pregnancy can weaken the bladder muscles, making it more difficult to control urination. This can also lead to a buildup of urine in the bladder. Pregnancy causes changes in the immune system, making pregnant women more susceptible to infections. The blood flow to the bladder increases during pregnancy, which can make it more swollen and vulnerable to infection. During pregnancy, the kidneys may not be able to filter glucose as effectively, which can lead to increased glucose levels in the urine. Glucose is a food source for bacteria, so it can contribute to UTIs [19, 20].

Conclusion

It can be concluded that the incidence of *E. coli*-UTI is high in the women in Iraq and the incidence of *E. coli*-UTI in pregnant women is higher than the incidence of *E. coli*-UTI in non-pregnant women.

Acknowledgments

In the end of this project, we want to thank all helpers who support our project especially the staff member of the department of biology, college of science, University of Wasit.

Funding information

This work received no specific grant from any funding agency.

Conflict of interest

The authors declare that they have no conflict of interests.

Ethical Approval

This review was approved by the Scientific Committee of the Ministry of Higher Education, Baghdad, Iraq (No 39, 2022).

6. REFERENCES

- [1] Hummers-Pradier E, Kochen MM. (2002) Urinary tract infections in adult general practice patients. *Br J Gen Pract* **52**:752-61. PMID: 12236281; PMCID: PMC1314418.
- [2] Zhang XJ, Shen Q, Yu YL, Sun YH, Yu GB, et al. (2008) Health seeking behavior and related influential factors on rural reproductive tract infections among rural women at reproductive age. *Zhonghua Liu Xing Bing Xue Za Zhi* **29**:1185-8. Chinese. PMID: 19173960.
- [3] Konwar M, Gogtay NJ, Ravi R, Thatte UM, Bose D. (2022) Evaluation of efficacy and safety of fosfomycin versus nitrofurantoin for the treatment of uncomplicated lower urinary tract infection (UTI) in women - A systematic review and meta-analysis. *J Chemother* **34**:139-148. doi: 10.1080/1120009X.2021.1938949. Epub 2021 Jun 21. PMID: 34151754.
- [4] Johnson JR, Porter SB, Johnston B, Thuras P, Clock S, et al. (2013) Crupain M, Rangan U. Extraintestinal Pathogenic and Antimicrobial-Resistant *Escherichia coli*, Including Sequence Type 131 (ST131), from Retail Chicken Breasts in the United States in 2013. *Appl Environ Microbiol* **83**:e02956-16. doi: 10.1128/AEM.02956-16. PMID: 28062464; PMCID: PMC5335533.
- [5] Alihosseini F, Ghaffari S, Dabirsiaghi AR, Haghghat S. (2015) Freezedrying of ampicillin solid lipid nanoparticles using mannitol as cryoprotectant. *Braz J Pharm Sci* **51**:2015 https://doi.org/10.1590/S1984-82502015000400005
- [6] Ab Hadi I, Bliss RD, Lennard TW, Welch AR. (2007) Primary squamous cell carcinoma of the thyroid gland: a case report and role of radiotherapy. *Surgeon* **5**:249-51. doi: 10.1016/s1479-666x(07)80010-2. PMID: 17849961.
- [7] Webber M, Piddock LJ. (2001) Quinolone resistance in *Escherichia coli*. *Vet Res* **32**:275-84. doi: 10.1051/vetres:2001124. Erratum in: *Vet Res* 2001 Nov-Dec;32(6):623. PMID: 11432418.
- [8] Hamdan HZ, Ziad AH, Ali SK, Adam I. (2011) Epidemiology of urinary tract infections and antibiotics sensitivity among pregnant women at Khartoum North Hospital. *Ann Clin Microbiol Antimicrob* **10**:2. doi: 10.1186/1476-0711-10-2. PMID: 21244660; PMCID: PMC3032644.
- [9] Oladeinde BH, Omoregie R, Oladeinde OB. (2015) Asymptomatic urinary tract infection among pregnant women receiving ante-natal care in a traditional birth home in Benin City, Nigeria. *Ethiop J Health Sci* **25**:3-8. doi: 10.4314/ejhs.v25i1.2. PMID: 25733779; PMCID: PMC4337079.
- [10] Brown AE, Smith HR. (2017) Benson's Microbiological Applications, Laboratory Manual in General Microbiology. 14th ed. McGraw-Hill Higher Education, New York. Pp: 438.
- [11] Risch M, Radjenovic D, Han JN, Wydler M, Nydegger U, Risch L. (2010) Comparison of MALDI TOF with conventional identification of clinically relevant bacteria. *Swiss Med Wkly* **140**:w13095. doi: 10.4414/sm.w.2010.13095. PMID: 20924806.
- [12] Moreno E, Andreu A, Pigrau C, Kuskowski MA, Johnson JR, Prats G. (2008) Relationship between *Escherichia coli* strains causing acute cystitis in women and the fecal *E. coli* population of the host. *J Clin Microbiol* **46**:2529-34. doi: 10.1128/JCM.00813-08. Epub 2008 May 21. PMID: 18495863; PMCID: PMC2519474.
- [13] Sandberg T, Kaijser B, Lidin-Janson G, Lincoln K, Orskov F, et al. (1988) Virulence of *Escherichia coli* in relation to host factors in women with symptomatic urinary tract infection. *J Clin Microbiol* **26**:1471-6. doi: 10.1128/jcm.26.8.1471-1476.1988. PMID: 3049654; PMCID: PMC266644.
- [14] Delzell JE Jr, Lefevre ML. (2000) Urinary tract infections during pregnancy. *Am Fam Physician* **61**:713-21. Erratum in: *Am Fam Physician* 61:3567. PMID: 10695584.
- [15] Kunin CM, Evans C, Bartholomew D, Bates DG. (2002) The antimicrobial defense mechanism of the female urethra: a reassessment. *J Urol* **168**:413-9. PMID: 12131279.
- [16] Linhares IM, Summers PR, Larsen B, Giraldo PC, Witkin SS. (2011) Contemporary perspectives on vaginal pH and lactobacilli. *Am J Obstet Gynecol* **204**:120.e1-5. doi: 10.1016/j.ajog.2010.07.010. Epub 2010 Sep 15. PMID: 20832044.
- [17] Mazzola BL, von Vigier RO, Marchand S, Tönz M, Bianchetti MG. (2003) Behavioral and functional abnormalities linked with recurrent urinary tract infections in girls. *J Nephrol* **16**:133-8. PMID: 12649544.
- [18] Lain SJ, Roberts CL, Warning J, Vivian-Taylor J, Ford JB. (2011) A survey of acute self-reported infections in pregnancy. *BMJ Open* **1**:e000083. doi: 10.1136/bmjopen-2011-000083. PMID: 22021755; PMCID: PMC3191429.
- [19] Ranjan A, Sridhar S, Matta N, Chokkakula S, Ansari R. (2017) Prevalence of UTI among Pregnant Women and Its Complications in Newborns. *Indian J Pharm Practice* **10**:45-49. https://doi.org/10.5530/IJOPP.10.1.10.
- [20] Loh K, Sivalingam N. (2007) Urinary tract infections in pregnancy. *Malays Fam Physician* **2**:54-7. PMID: 25606081; PMCID: PMC4170332.

Author affiliation

1. Department of Biology, College of Science, University of Wasit, Wasit, Iraq.
2. Department of Basic Sciences, College of Dentistry, University of Wasit, Wasit, Iraq.