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INCIDENCE OF URINARY TRACT INFECTIONS IN PREGNANT FEMALES OF DISTRICT PESHAWAR: THE ROLE OF AGE, GESTATIONAL PERIOD, AND LOCALITY

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Abstract

Urinary tract infections (UTIs) are among the most common bacterial infections affecting women during pregnancy, posing significant risks to maternal and fetal health if left untreated. This study was conducted to evaluate the incidence of UTIs among pregnant women in District Peshawar, with particular focus on variations based on age, trimester of pregnancy, and locality. A total of 250 pregnant women visiting the Rural Health Center Putwar Bala were assessed through urine pregnancy testing and routine urinalysis. Results revealed an overall UTI incidence of 76.4%, with the highest prevalence found among

women aged 25–30 years (38.8%) and those in their second trimester (40.8%). Furthermore, UTIs were more prevalent in rural areas (61.2%) compared to urban regions (15.2%). These findings suggest a strong correlation between UTI occurrence and both demographic and obstetric factors, emphasizing the need for routine screening and early intervention during prenatal care.

INTRODUCTION

Urinary tract infections (UTIs) are among the most common infections caused by bacteria. Accurately estimating their incidence is difficult, as UTIs are not reportable in most parts of the world. Diagnosis is further complicated by the fact that confirmation typically requires both a positive urine culture and the presence of symptoms. Among all infections, UTIs account for approximately 25% of cases. Certain subpopulations are at a higher risk of developing UTIs, including infants, pregnant women, the elderly, patients with spinal cord injuries or catheters, individuals with diabetes or multiple sclerosis, patients with acquired immunodeficiency syndrome (AIDS) or human immunodeficiency virus (HIV), and those with undiagnosed urologic abnormalities. Women are more susceptible to UTIs than men [1]. An infection affecting any part of the urinary tract is referred to as a urinary tract infection (UTI). When it involves the lower urinary tract, it is typically called a bladder infection (cystitis), whereas an infection involving the upper urinary tract is known as a kidney infection, or pyelonephritis [2]. The most common cause of UTIs is *Escherichia coli* (E. coli), although other bacteria or, less commonly, fungi may also be responsible. *Escherichia coli,* a facultative anaerobic Gram-negative bacillus, accounts for approximately 70–95% of community-acquired UTIs. Its virulence is largely attributed to specific adhesins (e.g., P fimbriae), hemolysins, and siderophores, which enable colonization and invasion of the uroepithelium. Other uropathogens may include *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterococcus faecalis*, and, less frequently, *Candida* species in immunocompromised hosts. These organisms can ascend the urinary tract

via the urethra, leading to inflammation and, in severe cases, pyelonephritis. Risk factors include female anatomy, sexual activity, diabetes, obesity, and a family history of UTIs [3].

Each year, approximately 150 million people worldwide experience a UTI, with women being disproportionately affected. In fact, UTIs are the most frequent bacterial infections among females. About 10% of women experience a UTI in any given year, and nearly half of all women will have at least one UTI at some point in their lives. The highest incidence is observed among women aged 16 to 35 years [4]. During pregnancy, common health concerns include vaginal inflammation and urinary tract infections caused by bacteria, both of which can lead to serious complications during childbirth. Pregnant women with bacterial vaginitis are at a significantly increased risk for UTIs [5]. This study was conducted to evaluate the incidence of urinary tract infections during pregnancy in the female population of District Peshawar.

MATERIALS AND METHODS

STUDY SETTING AND DATA COLLECTION

This study was carried out at the outpatient department of the Rural Health Center Putwar Bala, located on Warsak Road, Peshawar. The target population included pregnant women visiting the center for routine antenatal care. Data were collected through freshly voided urine samples provided by the participants. These samples were submitted to the clinical laboratory for analysis. Simultaneously, a structured questionnaire was filled out based on the results of the urine pregnancy test and urine routine examination to gather relevant clinical and demographic information pertaining to urinary tract infections (UTIs) during pregnancy.

SAMPLE SIZE AND COLLECTION

Urine samples were collected from a total of 250 pregnant women. Each participant was asked to provide a midstream urine sample in a sterile, dry container. Although samples collected at any time of the day were accepted,

early morning urine specimens were preferred due to the typically higher concentration of human chorionic gonadotropin (hCG). All samples were immediately transported to the laboratory of the Rural Health Center Putwar Bala for further analysis.

MICROSCOPIC AND BIOCHEMICAL EVALUATION AS PRESUMPTIVE MICROBIOLOGICAL INDICATORS

Although no microbial cultures were performed in this study due to resource limitations, microscopic examination of urine provided critical preliminary indicators of potential urinary tract infections. The presence of pyuria (defined as an elevated number of pus cells, or leukocytes, per high-power field) is a hallmark of inflammation in the urinary tract and suggests an ongoing immune response to microbial invasion. Bacteriuria, characterized by the visual detection of bacteria in uncentrifuged or centrifuged urine samples under microscopy, further supports the likelihood of an active infection, particularly when observed in conjunction with pyuria.

Additionally, the identification of cellular debris, including epithelial cells and mucus threads, may indicate urothelial shedding or irritation, which commonly occurs in response to pathogenic colonization or host immune responses. While these microscopic features are not species-specific and do not replace the diagnostic accuracy of urine culture and antimicrobial susceptibility testing, they are widely used in clinical microbiology as rapid, cost-effective screening tools in primary healthcare settings.

In the context of pregnant women—where timely identification of UTIs is crucial due to the risk of ascending infections and obstetric complications—such findings offer valuable presumptive microbiological evidence of infection and can inform early empirical treatment decisions pending further diagnostic confirmation.

URINE ROUTINE EXAMINATION

Each urine sample underwent a comprehensive routine examination, which included physical, chemical, and microscopic analyses. In the physical examination, the volume and color of the urine were assessed. A minimum of 20 milliliters of urine was considered sufficient for evaluation. The normal color of urine was recorded as pale yellow.

The chemical examination involved the detection of glucose (sugar), protein (albumin), and pH level. This was carried out using Uric-3V reagent strips, which are designed for in vitro diagnostic use. These reagent strips provide a semi-quantitative estimation of the aforementioned parameters, offering an immediate insight into the biochemical properties of the urine.

Microscopic analysis of urine was conducted to assess the presence of various cellular and crystalline elements. After centrifuging several milliliters of each urine sample in a capped test tube, the supernatant was discarded, leaving a small volume of sediment at the bottom. This sediment was gently mixed and a drop of it was placed on a clean glass slide using a pipette. The slide was then examined under a microscope to detect and quantify the presence of epithelial cells, pus cells, red blood cells, uric acid crystals, mucus threads, calcium oxalate crystals, and granular casts. The microscopic examination provided valuable information regarding the presence and severity of urinary tract infections.

URINE PREGNANCY TEST

The urine pregnancy test used in this study was based on lateral-flow immunoassay technology, which qualitatively detects the presence of hCG in urine. The test has a sensitivity threshold of 25 mIU/mL. The test strip consists of two regions: the test line and the control line. The test line contains monoclonal antibodies specific to hCG, which react with hCG in the sample. The control line contains goat polyclonal antibodies and colloidal gold particles to verify that the test was performed correctly.

To perform the test, a portion of the urine sample was added to the designated application area of the test device. The sample migrated along the membrane via capillary action, interacting with the immobilized antibodies. A positive result was indicated by the appearance of two colored lines: one at the test region and one at the control region. A negative result was indicated by a single colored line at the control region only. If no line appeared in the control region, the test was deemed invalid and was repeated.

This multi-step methodology ensured accurate detection and analysis of urinary tract infections and pregnancy status among the study participants.

RESULTS

A cross-sectional survey was conducted at the Rural Health Center Putwar Bala to assess the incidence of urinary tract infections (UTIs) among pregnant women in District Peshawar. A total of 250 pregnant patients were evaluated using urine pregnancy tests and routine urine examinations. The patients were categorized into age groups to analyze the distribution of UTIs across different age ranges.

URINE ANALYSIS PARAMETERS AS PRESUMPTIVE INDICATORS OF URINARY TRACT INFECTIONS

Table 1 presents a comprehensive summary of the physical, chemical, and microscopic parameters evaluated during routine urine analysis, with an emphasis on their microbiological relevance in the presumptive diagnosis of urinary tract infections (UTIs). Each parameter is categorized by the type of analysis performed and is accompanied by standard reference values. Key indicators such as pyuria (pus cells), bacteriuria, and proteinuria are highlighted due to their strong association with microbial infection and host immune response. The table also notes the potential diagnostic implications of urine pH and the presence of crystals or casts, which may reflect underlying metabolic or renal conditions contributing to infection risk. While not definitive without culture confirmation, these findings serve as valuable early

indicators in clinical microbiology, particularly in resource-limited settings or among vulnerable populations such as pregnant women..

TABLE-1: URINE ANALYSIS PARAMETERS AS PRESUMPTIVE INDICATORS OF URINARY TRACT INFECTIONS

Parameter	Type of Analysis	Normal Range / Reference Value	Microbiological Significance
Urine Color	Physical	Pale yellow	Dark or turbid urine may indicate infection, presence of pus cells, or hematuria.
Urine Volume	Physical	⩾20 mL per sample	Insufficient volume may compromise test accuracy; adequate volume ensures reliable sediment analysis.
Protein (Albumin)	Chemical (Uric-3V strip)	Negative to trace	Proteinuria can suggest inflammation or glomerular involvement due to infection.
Glucose (Sugar)	Chemical (Uric-3V strip)	Negative	May indicate undiagnosed diabetes mellitus, which is a known risk factor for recurrent UTIs.
pH	Chemical (Uric-3V strip)	4.6–8.0	Alkaline urine may suggest urea-splitting organisms like *Proteus spp.*; acidic pH is common in *E. coli* UTIs.
Pus Cells (Leukocytes)	Microscopic	0–5 cells/HPF	Pyuria is a hallmark of UTI, indicating immune response to bacterial invasion.

Red Blood Cells (RBCs)	Microscopic	0–3 cells/HPF	Hematuria may result from inflammation, irritation, or trauma due to infection.
Epithelial Cells	Microscopic	0–5 cells/HPF	Higher counts suggest contamination or epithelial irritation from infection.
Bacteria	Microscopic	None observed	Direct evidence of bacteriuria; significant in the presence of pyuria.
Mucus Threads	Microscopic	Few	Increased mucus may accompany infection-induced urothelial irritation.
Calcium Oxalate Crystals	Microscopic	Few	Usually non-pathogenic; excessive crystals may predispose to stone formation and secondary infection.
Uric Acid Crystals	Microscopic	Few	Typically incidental; occasionally linked with low urine pH.
Granular Casts	Microscopic	None to rare	May indicate renal involvement or tubular damage associated with severe infections.

INCIDENCE OF UTIS BY AGE GROUP

The distribution of UTIs among pregnant women was analyzed based on four age groups: 16–24, 25–30, 31–36, and 37–45 years. The findings are summarized in Table-2.

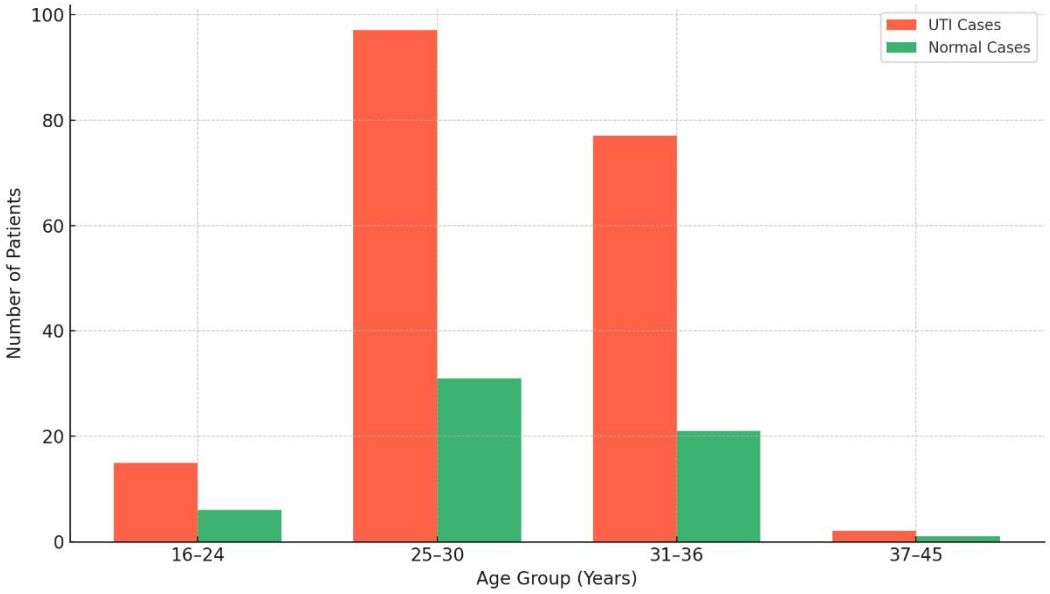
TABLE-2. INCIDENCE OF UTIS AMONG PREGNANT WOMEN BY AGE GROUP

Age Group (Years)	UTI Cases n (%)	Normal Cases n (%)	Total
16–24	15 (6.0%)	6 (2.4%)	21
25–30	97 (38.8%)	31 (12.4%)	128
31–36	77 (30.8%)	21 (8.4%)	98
37–45	2 (0.8%)	1 (0.4%)	3
Total	**191 (76.4%)**	**59 (23.6%)**	**250**

The 25–30 years age group had the highest number of participants, with 128 women in total. Of these, 97 (38.8%) were found to have UTIs, while 31 (12.4%) were free of infection. The 31–36 years age group included 98 women, of whom 77 (30.8%) tested positive for UTIs and 21 (8.4%) were normal. The youngest group, 16–24 years, comprised 21 patients; 15 (6.0%) had UTIs and 6 (2.4%) did not. The least represented age group was 37–45 years, which had only three participants. Among them, 2 (0.8%) were diagnosed with UTIs, while 1 (0.4%) was not.

Overall, 191 out of 250 pregnant women (76.4%) were diagnosed with UTIs, while 59 women (23.6%) showed no signs of infection. The data suggest a higher incidence of UTIs among women aged 25–36 years, indicating that this age range may represent a critical period of vulnerability to urinary tract infections during pregnancy (Figure-1)

FIGURE-1: INCIDENCE OF URINARY TRACT INFECTIONS AMONG PREGNANT WOMEN BY AGE GROUP.



INCIDENCE OF UTIS BASED ON TRIMESTER OF PREGNANCY

The distribution of urinary tract infections (UTIs) among pregnant women was further analyzed based on the trimester of pregnancy. A total of 250 pregnant patients were categorized into three groups according to their respective trimesters: first, second, and third. The results are summarized in Table-3.

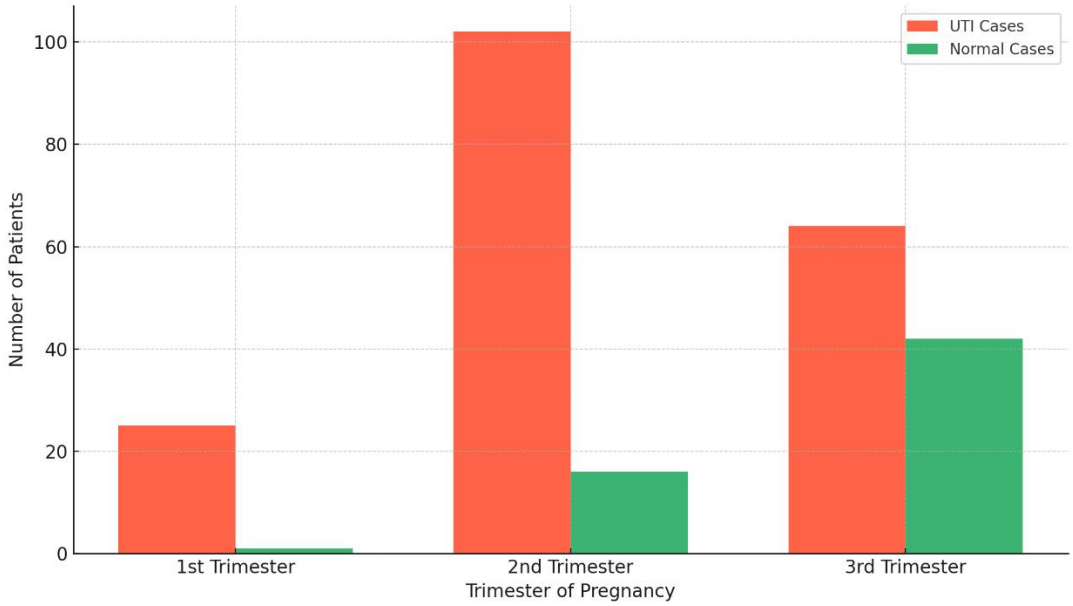
TABLE 3. INCIDENCE OF UTIS AMONG PREGNANT WOMEN BY TRIMESTER

Trimester	Total Patients n (%)	UTI Cases n (%)	Normal Cases n (%)
1st Trimester	26 (10.4%)	25 (10.0%)	1 (0.4%)
2nd Trimester	118 (47.2%)	102 (40.8%)	16 (6.4%)
3rd Trimester	106 (42.4%)	64 (25.6%)	42 (16.8%)
Total	**250 (100%)**	**191 (76.4%)**	**59 (23.6%)**

In the first trimester, 26 patients (10.4%) were assessed, out of which 25 (10.0%) were diagnosed with UTIs and only one patient (0.4%) was found to be normal. The second trimester group had the highest representation with 118 patients (47.2%). Among them, 102 (40.8%) were positive for UTIs while 16 (6.4%) were normal. In the third trimester, there were 106 patients (42.4%), of whom 64 (25.6%) had UTIs and 42 (16.8%) were free from infection.

The results indicate that the second trimester accounted for the highest number of UTI cases, followed by the third trimester. The first trimester, although with the smallest number of participants, showed a disproportionately high rate of infection, as 96% of women in that group had UTIs. These findings highlight the need for vigilant screening and management of UTIs at all stages of pregnancy, particularly in the second trimester where both the incidence and absolute number of cases were greatest (Figure-2).

FIGURE-2: INCIDENCE OF UTIS AMONG PREGNANT WOMEN BY TRIMESTER



INCIDENCE OF UTIS AMONG PREGNANT WOMEN BASED ON LOCALITY

The study population of 250 pregnant women was classified into two groups based on locality: rural and urban. The objective was to assess the distribution and prevalence of urinary tract infections (UTIs) among these populations. The findings are presented in Table-4.

TABLE-4. INCIDENCE OF UTIS AMONG PREGNANT WOMEN BY LOCALITY

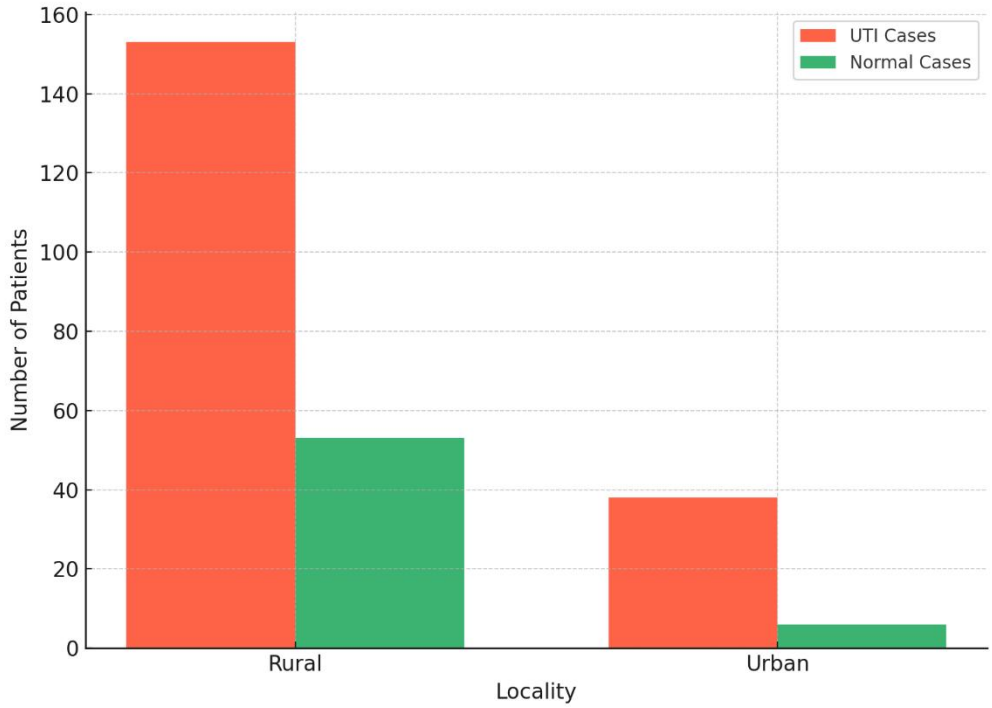
Locality	Total Patients n (%)	UTI Cases n (%)	Normal Cases n (%)
Rural	206 (82.4%)	153 (61.2%)	53 (21.2%)
Urban	44 (17.6%)	38 (15.2%)	6 (2.4%)

Total	**250 (100%)**	**191 (76.4%)**	**59 (23.6%)**

Out of the 250 participants, the rural population constituted the majority, with 206 women (82.4%). Among these, 153 (61.2%) were diagnosed with UTIs, while 53 (21.2%) were found to be free from infection. The urban group, comprising 44 women (17.6%), exhibited 38 UTI-positive cases (15.2%) and only 6 normal cases (2.4%). The data demonstrate a notably higher incidence of UTIs among rural residents compared to urban counterparts, both in absolute numbers and percentage terms. This disparity could be attributed to a range of socio-environmental factors including limited access to healthcare services, lower awareness of hygiene practices, and restricted availability of preventive screenings in rural areas.

These findings emphasize the importance of targeted public health interventions and educational programs in rural communities to reduce the burden of urinary tract infections during pregnancy (Figure-3).

FIGURE-3: INCIDENCE OF UTIS AMONG PREGNANT WOMEN BY LOCALITY



DISCUSSION

In our study the overall incidence of UTIs in pregnant females on the basis of age was 76.4 % . The age wise incidence of UTIs in females in our study was in the following percentage. Young age group females 16-24 years old patients evaluated for UTIs were 6 % positive and 2.4 % were negative. Age group 25-30 years old evaluated for UTIs were 38.8 % positive while 12.4 % were negative. The percentage of UTIs in 31-36 age group for positive and negative was 30.8 % and 8.4 % respectively. The age group 37-45+ showed 0.8 % positive results for UTIs while 0.4 % negative results for UTIs. Our results showed similarity with the study conducted by Al Rubeaan [6] in the way that 78 % young patients were suffered from UTI. UTI was most commonly witnessed in both genders in 60-65 years of group of age , whereas in the study carried out by Dinesh and his team, UTIs were more common in females of age group of 31-45 years [7]. Investigations done by Parveen [8] revealed also the similarity with our results as his results revealed the frequency of infection in the urinary tract to be 44.61 % within females of age group 21-25 years old.

Our study showed that out of 250 total female pregnant patients having three different trimesters of pregnancy the percentage of frequency of infection of urinary tract was not the same. The overall incidence of UTI in the first trimester of pregnancy was 10 % while normal were 0.4 % . Similarly in the second trimester the incidence of UTI was 40.8 % and normal was6.4 % .In third trimester of pregnancy the incidence of UTI was 25.6 % while 16.8 % was normal. The study showed similarity to the examination conducted by Okonko [9]. According to their study the frequency of infection in urinary tract by trimester period during pregnancy showed that the first trimester had 0 % UTI incidence while second trimester of pregnancy in females had 41.4 % incidence of UTI and third trimester of pregnancy had incidence of UTI 55.1 % respectively. According to the work done by [8,10] their findings showed

difference with our results as a greater number of infection was present in third trimester of pregnancy (78.46 %) while the frequency of infection in urinary tract first as well as second trimester was 9.23 % and 12.30 % respectively.

Our study showed that out of 250 female pregnant patients the incidence of UTI on the basis of locality of Rural area were in the percentage of 61.2 % positive and 21.2 % normal similarly the incidence in Urban area was 15.2 % positive and 2.4 % normal. According to the study performed by Anayet their results indicated difference with our results as they got 12 % incidence of UTI in Rural area which show contradiction to our 61.2 % results. Similarly the results of Khaliq show disagreement with our results as their findings of incidence of UTI in Rural area show 15 % while the incidence in Urban area is 85 %.

DISCUSSION

The present study assessed the incidence of urinary tract infections (UTIs) among pregnant women in District Peshawar, focusing on variables such as age, trimester of pregnancy, and locality. The overall prevalence of UTIs in the study population was found to be 76.4%, indicating a significantly high burden of infection among pregnant females.

Analysis by age groups revealed that the highest prevalence of UTIs occurred in the 25–30 years age group, with 38.8% testing positive for UTI and 12.4% testing negative. This was followed by the 31–36 years age group with a 30.8% incidence of UTI and 8.4% non-infected cases. The 16–24 years group accounted for 6% of UTI-positive cases and 2.4% negative cases, whereas the 37–45+ years group contributed only 0.8% to UTI-positive results and 0.4% to normal cases. These findings are consistent with the study conducted by Al Rubeaan [6], who also reported a high incidence of UTIs among younger female patients, with a prevalence of 78%. Similarly, Dinesh et al. [7] documented that UTIs were most common in the 31–45 years age group.

Additionally, the findings of Parveen [8] supported our results, noting a 44.61% frequency of UTIs in the 21–25 years age bracket.

In terms of gestational period, the second trimester exhibited the highest UTI incidence at 40.8%, followed by the third trimester with 25.6%, and the first trimester with 10%. These results align with the findings of Okonko [9], who reported UTI incidences of 41.4% in the second trimester and 55.1% in the third trimester, although his study noted 0% incidence during the first trimester. Conversely, studies by [8,10] revealed differing patterns, with a 78.46% incidence in the third trimester, and lower frequencies in the first (9.23%) and second trimesters (12.30%), contrasting with the trends observed in our study. The variation in UTI incidence across trimesters may be attributed to physiological and hormonal changes, particularly in the second trimester, which favor urinary stasis and bacterial colonization due to reduced bladder tone and ureteral dilation.

Locality-wise distribution revealed that pregnant women from rural areas had a markedly higher incidence of UTIs, with 61.2% testing positive, compared to 15.2% in urban areas. The number of non-infected participants was also higher in rural areas (21.2%) compared to urban regions (2.4%). These findings contrast with the results of Anayet, who reported a significantly lower UTI incidence in rural populations at 12%, suggesting a possible underestimation or better hygiene awareness in their study group. Similarly, studies showed a reversed trend, reporting only 15% UTI prevalence in rural areas and a considerably higher 85% in urban populations. This discrepancy could be influenced by differences in sample size, healthcare access, socio-economic status, or environmental hygiene conditions.

CONCLUSION

The present study concluded that the overall incidence of urinary tract infections (UTIs) among pregnant women in District Peshawar was notably high at 76.4%. The highest infection rate was observed in women aged 25–30

years, accounting for 38.8% of the UTI-positive cases. In terms of gestational age, the second trimester showed the greatest susceptibility, with a UTI incidence of 40.8%. Furthermore, the majority of cases were reported from rural areas, where 61.2% of participants tested positive, highlighting the influence of geographical and healthcare access factors. These findings emphasize that age, trimester, and locality are significant contributors to UTI prevalence in pregnancy and suggest a critical need for focused screening and preventive care in antenatal settings.

FUTURE RECOMMENDATIONS

It is recommended that routine screening for UTIs be integrated into antenatal care, particularly during the second trimester and in rural healthcare facilities. Efforts should be made to raise awareness about UTI prevention and early diagnosis among pregnant women, especially in underserved areas. Improving access to diagnostic services and treatment in rural centers is essential to reduce complications associated with untreated infections. Future studies should consider long-term monitoring of maternal and neonatal outcomes, explore antibiotic resistance patterns in local uropathogens, and investigate the socio-economic factors contributing to infection risk. These measures can support more effective management and policy planning for maternal health.

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