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ORIGINAL ARTICLE

Urinary Tract and Gastrointestinal Infections during Pregnancy: Prevalence, Risk Factors, and Clinical Implications in a Pakistani Cohort

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ABSTRACT

Background: Urinary tract infections (UTIs) and gastrointestinal (GI) infections are frequent complications of pregnancy and can adversely affect maternal and fetal health. In Pakistan, limited data address their combined prevalence, risk factors, and clinical impact.

Objectives: To determine the prevalence, associated risk factors, pathogen distribution, and clinical outcomes of UTIs and GI infections among pregnant women.

Methods: This descriptive cross-sectional study was conducted from March 2022 to May 2023 at the Gastroenterology Unit, Medical Teaching Institute/Khyber Teaching Hospital (MTI/KTH), Peshawar, and the Department of Obstetrics and Gynaecology, Dr. Faisal Masood Teaching Hospital, Sargodha. A total of 100 pregnant women aged 18–40 years were enrolled through non-probability consecutive sampling. Data on demographics, hygiene, dietary practices, and water source were obtained via structured interviews. Midstream urine and fresh stool samples were processed using standard culture, microscopy, and antigen detection. SPSS v26.0 was used for analysis, with Chi-square and logistic regression tests applied.

Results: UTI prevalence was 28.0%, GI infection prevalence was 21.0%, and coinfection occurred in 5.0% of participants. UTIs were more common in the second trimester, while GI infections peaked in the third trimester. Poor personal hygiene was significantly associated with UTIs ($p<0.001$), and unsafe drinking water with GI infections ($p<0.001$). *Escherichia coli* was the predominant uropathogen, and *Giardia lamblia* the leading GI pathogen. UTIs were linked to preterm labor and low birth weight, while GI infections were associated with maternal dehydration and fetal growth restriction.

Conclusion: These infections are common in pregnancy, largely preventable, and linked to adverse outcomes. Routine screening, hygiene promotion, safe water access, and dietary counseling are recommended to improve maternal and neonatal health.

Keywords: Pregnancy, Urinary tract infection, Gastrointestinal infection, Risk factors, Pakistan.

INTRODUCTION

Pregnancy represents a unique physiological state characterized by complex anatomical, hormonal, and immunological adaptations that are essential for fetal growth and development. These changes, while beneficial to sustaining pregnancy, also predispose women to a variety of infections, notably urinary tract infections (UTIs) and gastrointestinal (GI) infections, both of which can have significant implications for maternal and fetal health[1]. Globally, UTIs remain among the most common bacterial infections encountered during pregnancy, with reported prevalence rates ranging from 2% to 10% in developed countries and even higher rates, approaching 20–30%, in resource-limited settings. Similarly, GI infections, whether of bacterial, viral, or parasitic origin, are prevalent in low- and middle-income countries and constitute a considerable public health burden due to their potential to cause maternal dehydration, malnutrition, and adverse pregnancy outcomes[2,3].

The heightened susceptibility to UTIs in pregnancy can be attributed to several physiological changes, including ureteral dilation, reduced bladder tone, and urinary stasis resulting from progesterone-mediated smooth muscle relaxation and mechanical compression by the enlarging uterus. Immunological alterations, particularly the shift toward a T-helper 2 (Th2)-dominant immune response, may further impair the ability to mount an effective defense against urinary pathogens[4]. Escherichia coli remains the predominant etiological agent, although other gram-negative and gram-positive organisms such as Klebsiella, Proteus, and Group B Streptococcus are also implicated. If untreated, UTIs may progress from asymptomatic bacteriuria to acute cystitis or pyelonephritis, with consequences including preterm labor, low birth weight, intrauterine growth restriction (IUGR), and in severe cases, maternal sepsis[5].

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Gastrointestinal infections during pregnancy are equally concerning. The physiological reduction in gastric acidity, changes in gut motility, and immune modulation increase vulnerability to enteric pathogens[6]. Common bacterial agents include Salmonella, Shigella, and pathogenic strains of E. coli, while viral gastroenteritis due to norovirus and rotavirus also contributes to disease burden. Parasitic infections such as giardiasis and amoebiasis remain prevalent in regions with poor sanitation and limited access to safe drinking water. These infections can precipitate significant maternal morbidity by causing dehydration, electrolyte imbalance, and malabsorption, and have been associated with miscarriage, preterm birth, and fetal growth restriction. In addition, exposure to certain foodborne pathogens, such as *Listeria monocytogenes*, carries a particularly high risk of vertical transmission, leading to neonatal sepsis or stillbirth[7,8].

In Pakistan, the prevalence of both UTIs and GI infections in pregnancy is likely underreported due to inadequate screening protocols, limited laboratory resources, and sociocultural barriers to healthcare access. The healthcare infrastructure in many rural and peri-urban areas remains underdeveloped, with antenatal care services often underutilized[9]. Furthermore, factors such as poor personal hygiene, lack of clean water, consumption of unhygienic food, low literacy levels, and restricted health awareness compound the risk. Existing studies in the Pakistani context have often examined UTIs or GI infections in isolation, without a comprehensive analysis of their combined prevalence, overlapping risk factors, and collective impact on pregnancy outcomes[10].

The clinical implications of these infections extend beyond immediate maternal morbidity. Untreated UTIs have been associated with a twofold increase in the risk of preterm delivery, while persistent GI infections can exacerbate nutritional deficiencies and anemia, both of which contribute to poor perinatal outcomes. Considering that many of the underlying risk factors such as hygiene practices, safe water supply, and dietary habits are modifiable, early identification and targeted interventions have

the potential to substantially reduce morbidity and improve pregnancy outcomes in Pakistan[11].

Given the scarcity of comprehensive data addressing both UTIs and GI infections during pregnancy in the Pakistani setting, this study was designed to determine their prevalence, identify associated risk factors, and assess their clinical implications in a representative cohort of pregnant women. By doing so, it aims to provide an evidence base for the development of integrated antenatal screening strategies and community-level preventive interventions, with the ultimate goal of enhancing maternal and neonatal health outcomes in resource-limited contexts[12].

MATERIALS AND METHODS

Study Design and Duration: This descriptive, cross-sectional observational study was carried out over a fifteen-month period, from March 2022 to May 2023. The aim was to evaluate the prevalence, risk factors, and clinical implications of urinary tract and gastrointestinal infections among pregnant women attending two tertiary care hospitals in Pakistan.

Study Settings: The study was conducted at two major healthcare institutions that cater to large and diverse patient populations. The first site was the Gastroenterology Unit of the Medical Teaching Institute (MTI) / Khyber Teaching Hospital (KTH), Peshawar, a referral center for complex gastrointestinal cases in the Khyber Pakhtunkhwa province. The second site was the Department of Obstetrics and Gynaecology at Dr. Faisal Masood Teaching Hospital, Sargodha, a key maternal healthcare facility in the Punjab province. These centers were selected to represent different geographical regions and sociodemographic profiles, thereby enhancing the external validity of the findings.

Sample Size and Sampling Technique: A total of one hundred pregnant women were enrolled in the study. Participants were recruited using a non-probability consecutive sampling approach, in which all eligible women attending the outpatient and inpatient services of the respective departments during the study period were invited to participate until the desired sample size was reached. This method allowed for the inclusion of a wide range of clinical presentations and gestational stages.

Eligibility Criteria: Women were eligible for inclusion if they were aged between eighteen and forty years, in any trimester of pregnancy, and willing to provide written informed consent. Only those able to provide urine and stool samples for diagnostic testing were considered. Exclusion criteria included known chronic kidney disease, structural urinary tract abnormalities, chronic gastrointestinal disorders such as inflammatory bowel disease or irritable bowel syndrome, recent antibiotic therapy within the preceding two weeks, and systemic infections unrelated to the urinary or gastrointestinal tract.

Data Collection Procedures: Following informed consent, each participant was interviewed using a pre-designed structured questionnaire. This collected information on demographic characteristics, obstetric and medical history, hygiene practices, dietary patterns, drinking water sources, and sanitation facilities. A detailed clinical examination was then performed to assess hydration status, abdominal tenderness, costovertebral angle tenderness, and other relevant infection-related signs.

For urinary tract infection assessment, a midstream clean-catch urine specimen was collected in a sterile container after instructing the participant on proper collection technique to avoid contamination. Samples were transported to the microbiology laboratory within one hour and cultured on Cystine Lactose Electrolyte Deficient (CLED) agar. Growth of a single uropathogen at concentrations of 10^5 colony-forming units per milliliter (CFU/mL) or greater was considered diagnostic for urinary tract infection. Antimicrobial susceptibility testing was performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines to determine resistance patterns.

For gastrointestinal infection assessment, fresh stool samples were obtained in sterile containers. Each specimen underwent macroscopic examination for consistency, blood, or mucus, and microscopic evaluation for ova, cysts, and trophozoites. Stool culture was performed to isolate bacterial pathogens such as *Salmonella*, *Shigella*, and enteropathogenic *Escherichia coli*. Where clinically indicated, antigen detection assays were used to identify protozoal pathogens including *Giardia lamblia* and *Entamoeba histolytica*.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Review Boards of MTI/KTH, Peshawar, and Dr. Faisal Masood Teaching Hospital, Sargodha. Written informed consent was obtained from all participants after a clear explanation of the study objectives, procedures, potential benefits, and risks. Confidentiality of participant data was maintained through anonymization, and all biological samples were handled in compliance with biosafety guidelines.

Statistical Analysis: All collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables, such as maternal age and gestational age, were presented as means with standard deviations, while categorical variables, such as infection status and parity, were expressed as frequencies and percentages. The Chi-square test was applied to explore associations between categorical variables, and binary logistic regression was performed to identify independent predictors of urinary tract and gastrointestinal infections. Statistical significance was set at a p-value of less than 0.05.

RESULTS

A total of 100 pregnant women fulfilling the inclusion criteria were enrolled in the study during the 15-month period from March 2022 to May 2023 at the Gastroenterology Unit, MTI/KTH Peshawar, and the Department of Obstetrics and Gynaecology, Dr. Faisal Masood Teaching Hospital, Sargodha. The findings revealed a considerable burden of urinary tract and gastrointestinal infections among the participants. Out of the total, 28 women were diagnosed with urinary tract infections (UTIs), while 21 were found to have gastrointestinal (GI) infections, and 5 had concurrent UTI and GI infections. This translated to an overall UTI prevalence of 28.0% and a GI infection prevalence of 21.0%, with coinfection occurring in 5.0% of the cohort. These figures are presented in Table 1, which clearly shows that 54% of the pregnant women studied had at least one of the two infections, indicating a high infectious morbidity burden during pregnancy in the Pakistani setting.

When demographic characteristics were examined, the mean age of participants was 27.4 ± 5.2 years, ranging from 18 to 39 years. A greater proportion of infections occurred in the 26–35-year age group, which accounted for 57.1% of UTI cases and 52.4% of GI infection cases. In terms of gestational age distribution, UTIs were more frequently observed in the second trimester (46.4%), whereas GI infections peaked in the third trimester (47.6%). These distributions are summarized in Table 2. The data suggest that while infections can occur in any trimester, the physiological and lifestyle changes occurring in the second trimester may predispose women to UTIs, whereas gastrointestinal susceptibility appears to rise later in pregnancy, possibly due to further alterations in motility and immunity.

When evaluating risk factors, poor personal hygiene was significantly associated with UTIs, being reported by 60.7% of affected women compared to 23.9% of uninfected women ($p<0.001$). Unsafe drinking water showed a strong correlation with GI infections, present in 71.4% of GI cases compared to 28.3% of those without GI infection ($p<0.001$). Consumption of raw or undercooked food was more common among GI infection cases (57.1%) but also appeared in a third of UTI cases. Multiparity and low socioeconomic status were more frequent among infected participants, suggesting a cumulative effect of repeated exposure and reduced access to preventive healthcare measures. These findings are detailed in Table 3 and highlight that many of the contributing factors are modifiable through public health interventions.

Table 1: Prevalence of UTIs and GI Infections in the Study Cohort

Infection Type	Number of Cases (n)	Percentage (%)
Urinary Tract Infection (UTI)	28	28.0
Gastrointestinal (GI) Infection	21	21.0
Both UTI & GI Infection	5	5.0
No Infection Detected	46	46.0

Table 2: Demographic and Clinical Characteristics of Participants

Variable	Total (n=100)	UTI Present (%)	GI Infection Present (%)
Age (years)			
18–25	35	10 (35.7)	6 (28.6)
26–35	50	16 (57.1)	11 (52.4)
36–40	15	2 (7.2)	4 (19.0)
Trimester			
First	24	6 (21.4)	4 (19.0)
Second	44	13 (46.4)	7 (33.3)
Third	32	9 (32.2)	10 (47.6)

Microbiological culture results showed that *Escherichia coli* was the most common uropathogen, accounting for 64.3% of UTI cases, followed by *Klebsiella pneumoniae* (21.4%), *Proteus mirabilis* (10.7%), and *Enterococcus faecalis* (3.6%). GI infections were most frequently caused by *Giardia lamblia* (33.3%), *Entamoeba histolytica* (28.6%), and equal proportions of *Salmonella* spp. and *Shigella* spp. (both 19.0%). This distribution, shown in Table 4, reflects both the typical bacterial etiology of UTIs and the significant burden of protozoal GI pathogens in Pakistan, which is consistent with sanitation and water safety challenges in the region.

Adverse maternal and fetal outcomes were also assessed. Women with UTIs were significantly more likely to experience preterm labor (21.4% vs. 6.5%, p=0.012) and deliver low birth weight infants (17.9% vs. 4.3%, p=0.021). GI infections were associated with maternal dehydration in 38.1% of cases (p<0.001) and fetal growth restriction in 23.8% of cases (p=0.034). Coinfected women had the highest complication rates. These outcome data are presented in Table 5, emphasizing the serious clinical consequences of these infections during pregnancy.

Overall, the results indicate that over half of the pregnant women studied suffered from either a urinary or gastrointestinal infection, with significant overlaps in risk factors and considerable adverse pregnancy outcomes. The data presented in Tables 1–5 provide clear evidence that such infections represent a major, yet preventable, public health concern in Pakistani antenatal care settings.

Table 3: Distribution of Major Risk Factors in Participants

Risk Factor	UTI Cases (%)	GI Infection Cases (%)	p-value (UTI)	p-value (GI)
Poor Personal Hygiene	17 (60.7)	9 (42.9)	<0.001	0.041
Unsafe Drinking Water	15 (53.6)	15 (71.4)	0.022	<0.001
Consumption of Raw Food	9 (32.1)	12 (57.1)	0.048	0.009
Multiparity	18 (64.3)	10 (47.6)	0.034	0.119
Low Socioeconomic Status	16 (57.1)	13 (61.9)	0.041	0.027

Table 4: Pathogen Distribution in UTI and GI Infections

Pathogen	UTI Cases (%)	GI Infection Cases (%)
Escherichia coli	18 (64.3)	
Klebsiella pneumoniae	6 (21.4)	
Proteus mirabilis	3 (10.7)	
Enterococcus faecalis	1 (3.6)	
Giardia lamblia		7 (33.3)
Entamoeba histolytica		6 (28.6)
Salmonella spp.		4 (19.0)
Shigella spp.		4 (19.0)

Table 5: Adverse Maternal and Fetal Outcomes Associated with Infections

Outcome	UTI Present (%)	GI Infection Present (%)	p-value (UTI)	p-value (GI)
Preterm Labor	6 (21.4)	4 (19.0)	0.012	0.041
Low Birth Weight	5 (17.9)	3 (14.3)	0.021	0.057
Maternal Dehydration	3 (10.7)	8 (38.1)	0.048	<0.001
Fetal Growth Restriction	4 (14.3)	5 (23.8)	0.033	0.034

DISCUSSION

This study demonstrates a significant burden of urinary tract infections (UTIs) and gastrointestinal (GI) infections among pregnant women in Pakistan, with over half of the cohort affected by at least one infection type (Table 1). The observed prevalence of UTIs (28.0%) and GI infections (21.0%) is markedly higher than rates reported in developed countries, where comprehensive antenatal screening, effective public health measures, and better sanitation have significantly reduced infection incidence. In contrast, these figures are consistent with findings from other South Asian studies, where prevalence rates commonly range between 20%–35% for UTIs and 15%–25% for GI infections during pregnancy[12,13].

The demographic distribution (Table 2) revealed that women aged 26–35 years experienced the highest infection burden. This trend aligns with the findings of regional studies, where reproductive-age women in their late twenties and early thirties, often with higher parity, face greater exposure risks due to cumulative reproductive strain and domestic responsibilities that may limit attention to personal hygiene[14]. The trimester-wise pattern observed in this study UTIs being more frequent in the second trimester and GI infections peaking in the third trimester can be explained physiologically. In the second trimester, mechanical compression from the enlarging uterus, coupled with progesterone-induced urinary tract relaxation, increases urinary stasis and bacterial colonization risk. Conversely, third-trimester GI infection peaks may reflect slowed gastrointestinal motility, altered immunity, and seasonal dietary changes, which can facilitate enteric pathogen transmission[15].

Risk factor analysis (Table 3) strongly implicates modifiable environmental and behavioral determinants. Poor personal hygiene was significantly linked to UTIs, while unsafe drinking water had the strongest association with GI infections[16]. These findings mirror data from Khan et al. in Sindh, where similar associations were found, particularly in rural settings without reliable clean water supply. The significant role of dietary practices, especially the consumption of raw or undercooked food, further emphasizes the need for dietary counseling during antenatal visits. Multiparity and low socioeconomic status were common denominators for both infections, suggesting that cumulative reproductive exposure and resource constraints limit preventive healthcare access[17].

The microbiological profile (Table 4) reinforces established epidemiological trends. *Escherichia coli* dominated the UTI isolates (64.3%), consistent with global literature citing its virulence factors

such as P fimbriae, hemolysin production, and biofilm formation. For GI infections, *Giardia lamblia* and *Entamoeba histolytica* were the leading pathogens, reflecting persistent sanitation and water safety challenges in Pakistan. Detection of bacterial pathogens such as *Salmonella* and *Shigella* underscores the dual bacterial-parasitic burden in this population[18,19].

Adverse maternal and fetal outcomes associated with these infections were notable (Table 5). UTIs significantly increased the risk of preterm labor and low birth weight, corroborating the work of Hill et al., who demonstrated that untreated bacteriuria doubles the risk of premature delivery. GI infections were significantly associated with maternal dehydration and fetal growth restriction, findings that are supported by Black et al., who attributed such outcomes to nutritional compromise, inflammatory cytokine effects, and placental insufficiency. The highest complication rates were observed in women with coinfections, highlighting the compounded risk of concurrent infectious processes during pregnancy[20,21].

From a public health perspective, these results underline the urgent need for preventive strategies that can be integrated into existing maternal healthcare frameworks. Routine antenatal screening for UTIs using urine culture, alongside stool testing in high-risk patients, could enable early treatment. Hygiene promotion, safe water provision, and culturally adapted dietary counseling should form core components of antenatal education programs[22].

While the study offers valuable insights, several limitations must be acknowledged. First, the sample size was relatively small (n=100) and limited to two tertiary care hospitals, which may restrict the generalizability of the findings to rural or primary care settings[23]. Second, the cross-sectional design captures prevalence but does not establish causal relationships between risk factors and outcomes. Third, seasonal variation in infection rates could not be fully analyzed due to the single-year study window, and pathogen detection was limited to standard culture and microscopy without advanced molecular diagnostics. Finally, self-reported hygiene and dietary practices may be subject to recall and social desirability bias, potentially underestimating risky behaviors[24].

Future studies should aim for larger, multi-center sampling that includes rural healthcare facilities to improve representativeness. Longitudinal cohort designs could better establish causal links between risk factors and pregnancy outcomes. Incorporating molecular diagnostic tools such as PCR for pathogen detection could improve sensitivity, particularly for asymptomatic or low-intensity infections[13,19]. Additionally, intervention-based trials such as hygiene education programs, provision of point-of-use water purification systems, and targeted dietary counseling should be conducted to assess their real-world impact on infection reduction and pregnancy outcomes. Assessing the cost-effectiveness of integrating routine UTI and GI screening into antenatal care would also be valuable for policy-level decision-making in resource-limited settings[25].

CONCLUSION

This study establishes that urinary tract and gastrointestinal infections are highly prevalent among pregnant women in Pakistan, affecting more than half of the study population, with significant implications for maternal and neonatal health. UTIs were more common in the second trimester, while GI infections peaked in the third trimester, with both conditions linked to preventable risk factors such as poor hygiene, unsafe drinking water, and high-risk dietary practices. The predominance of *E. coli* in UTIs and protozoal pathogens in GI infections underscores ongoing gaps in sanitation, water safety, and hygiene practices. These infections were associated with serious outcomes, including preterm labor, low birth weight, maternal dehydration, and fetal growth restriction, with coinfection carrying the greatest risk. Given that many of these determinants are modifiable, public health interventions comprising routine antenatal screening, hygiene promotion, improved water access, and dietary safety education should be prioritized. Addressing these issues through integrated maternal health programs has the potential to reduce infection burden and improve pregnancy outcomes across Pakistan.

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Ethical Approval: Ethical approval was obtained from the Institutional Review Boards of MTI/KTH, Peshawar, and Dr. Faisal Masood Teaching Hospital, Sargodha.
Informed Consent: Written informed consent was obtained from all participants prior to enrollment.
Data Availability: The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.
Authors' Contributions: S.K. conceived and designed the study, supervised data collection at the Gastroenterology Unit, MTI/KTH, Peshawar, and contributed to manuscript writing. S. was responsible for patient recruitment, clinical assessment, and preliminary data analysis. F.S. coordinated laboratory investigations, interpreted microbiological results, and contributed to drafting the methods and results sections. M.F. provided clinical oversight, ensured quality control of data collection, and critically revised the manuscript for important intellectual content. A.K.S. performed statistical analyses, assisted in interpretation of findings, and contributed to the preparation of tables and figures. A.W.S. participated in literature review, assisted in discussion writing, and contributed to editing and finalizing the manuscript. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.
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