ASSOCIATION BETWEEN ROUTINE URINALYSIS FINDINGS AND URINE PREGNANCY TEST RESULTS AMONG WOMEN OF REPRODUCTIVE AGE

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Abstract
Urinalysis and urine pregnancy testing (UPT) are routinely performed diagnostic procedures in women of reproductive age; however, their potential association remains unclear. This study aimed to evaluate the relationship between routine urine examination (RUE) findings and urine pregnancy test results among females of reproductive age. A cross-sectional analytical study was conducted on 100 urine samples collected from females undergoing both urinalysis and UPT. Routine urinalysis included physical, chemical, and microscopic examination, while UPT was performed using standard qualitative detection of human chorionic gonadotropin (hCG). The findings demonstrated a high prevalence of urinary abnormalities, with 91% of participants showing features suggestive of urinary tract infection (UTI). Statistical analysis revealed no significant correlation between routine urine parameters—including proteinuria, pus cells, hematuria, leukocyte esterase, nitrite, and bacteriuria—and UPT results (Spearman's $\rho < .15$, $p > .05$). The only variable significantly associated with positive UPT was amenorrhea (OR = 5.68, $p < .001$), highlighting its importance as a primary clinical indicator of pregnancy. These results indicate that routine urinalysis findings are not reliable predictors of pregnancy status. Although urinalysis is essential for diagnosing urinary tract infections and other renal conditions, it should not be used as a substitute for pregnancy testing. Urine pregnancy tests remain the gold standard for detecting pregnancy, and their interpretation should be supported by clinical history and confirmatory investigations when necessary.

Introduction
Urine is one of the most frequently analyzed biological specimens in clinical practice, offering valuable insights into physiological and pathological conditions. Routine urinalysis (RUE) is a cost-effective, non-invasive, and widely accessible diagnostic tool used to detect urinary tract infections (UTIs), renal disorders, metabolic abnormalities, and systemic diseases such as diabetes mellitus (Cheesbrough, 2018). Standard

urinalysis comprises physical, chemical, and microscopic examinations, enabling comprehensive assessment of urine characteristics and constituents (World Health Organization [WHO], 2020).

In parallel, the urine pregnancy test (UPT) is a rapid qualitative method used to detect human chorionic gonadotropin (hCG), a hormone produced shortly after implantation. Due to its simplicity, affordability, and quick turnaround time, UPT is widely utilized for early pregnancy detection (Sharma et al., 2021). However, the accuracy of UPT depends on several pre-analytical and analytical factors, particularly urine concentration and sample integrity. Diluted urine may lead to false-negative results due to reduced hCG concentration, while contamination or the presence of proteins, blood, or infection may occasionally contribute to erroneous interpretations (Khan & Fatima, 2019).

Women of reproductive age (15–45 years) frequently undergo both urinalysis and pregnancy testing as part of routine clinical evaluation. Physiological changes, hormonal fluctuations, and increased susceptibility to UTIs during this period may influence urine composition (Patel & Desai, 2020). In developing healthcare settings such as Pakistan, where laboratory testing serves as a primary diagnostic approach, improper sample collection and limited awareness of pre-analytical variables can further compromise test accuracy (Khalid & Ahmad, 2018).

Routine urinalysis is a fundamental diagnostic tool that provides essential information about urinary and systemic health. It includes physical, chemical, and microscopic evaluation of urine to detect abnormalities such as proteinuria, hematuria, glucosuria, and leukocyturia (Cheesbrough, 2018; Simerville et al., 2005). These parameters are commonly used to diagnose UTIs, renal disorders, and metabolic conditions. However, physiological changes during pregnancy—such as increased glomerular filtration rate and hormonal alterations—may influence urinalysis findings, complicating their interpretation (Werter et al., 2024).

Urine pregnancy tests detect hCG, a hormone specific to pregnancy, and are not directly influenced by most urinary constituents. Nonetheless, several factors can affect UPT accuracy. Dilute urine, often reflected by low specific gravity, may reduce hCG concentration and result in false-negative outcomes (Gronowski et al., 2009; Priyadarshini et al., 2022). Conversely, severe proteinuria or infection has been reported in rare cases to interfere with test performance, potentially leading to false-positive results (Delanghe et al., 2024).

Individual urinalysis parameters have been studied extensively; however, their relationship with UPT outcomes remains unclear. Proteinuria may occur physiologically during pregnancy due to increased renal filtration but does not directly correlate with hCG detection (Khan et al., 2024). Similarly, leukocyte esterase and nitrite tests are useful indicators of UTIs but have moderate sensitivity and specificity, and their association with pregnancy test results has not been established (Kim et al., 2020). Hematuria, glycosuria, and variations in urine pH are also influenced by physiological and pathological factors but lack evidence of direct impact on UPT accuracy (Cole, 2021; Sharma et al., 2022).

Urine concentration, reflected by specific gravity, is one of the few factors theoretically linked to UPT sensitivity, as it may influence hCG detectability in early pregnancy. However, no studies have systematically evaluated this relationship (Cole, 2021). Similarly, microscopic findings such as epithelial cells, casts, and crystals are valuable for diagnosing renal conditions but have no proven association with pregnancy test outcomes (Liu et al., 2024).

The aim was to analyze routine urinalysis findings among women undergoing urine pregnancy testing. To evaluate the influence of urinalysis abnormalities on urine pregnancy test results. To determine the association between routine urinalysis parameters and UPT outcomes.

Research Questions

1. Is there an association between routine urinalysis findings and urine pregnancy test results?
2. Which urinalysis parameters, if any, are linked to pregnancy test positivity?

3. Can routine urinalysis contribute to early pregnancy detection?

Methodology

Research Design

A cross-sectional analytical study design was employed to examine the correlation between routine urine examination findings and urine pregnancy test (UPT) results among females of reproductive age. This design enabled the assessment of associations between variables at a single point in time without manipulation, making it appropriate for laboratory-based observational research.

Study Setting and Duration

The study was conducted in the clinical laboratory of Farhat Hospital, Lahore, Pakistan, a facility equipped with standard diagnostic services for urinalysis and pregnancy testing. Data were collected over a three-month period from January to March 2024.

Study Population and Sample Size

The study population comprised females of reproductive age (15–49 years) presenting for laboratory investigations and undergoing both routine urine examination and UPT. A total of 100 urine samples were included. The sample size was calculated using the standard formula ($n = Z^2p(1-p)/d^2$) with a 95% confidence level ($Z = 1.96$), estimated prevalence ($p = 0.5$), and margin of error ($d = 0.1$), yielding a minimum of 96 samples, which was increased to 100 to enhance reliability.

Sampling Technique

A non-probability convenience sampling method was used to recruit participants based on accessibility and eligibility during the study period.

Eligibility Criteria

Inclusion criteria included females aged 15–49 years who underwent both urinalysis and UPT and provided freshly collected urine samples with informed willingness to participate. Exclusion criteria comprised females outside the reproductive age range, patients who did not undergo both tests, contaminated or improperly collected samples, and incomplete laboratory records.

Data Collection Procedure

Urine samples were collected in sterile containers following standard guidelines to minimize contamination. Each specimen was labeled and processed promptly. Routine urinalysis included physical examination (color, clarity), chemical analysis using dipstick methods (protein, glucose, pH, ketones, leukocytes), and microscopic evaluation of urinary sediment (red blood cells, pus cells, epithelial cells, casts, and bacteria).

UPT was performed using commercially available immunoassay kits for qualitative detection of human chorionic gonadotropin (hCG) in urine. Results were interpreted as positive or negative according to manufacturer instructions. All observations were systematically recorded using a structured data sheet.

Data Analysis

Data were analyzed using descriptive and inferential statistics. Frequencies and percentages were calculated for categorical variables. The association between urinalysis parameters and UPT results was assessed using appropriate correlation analysis (e.g., chi-square test). Results were presented in tabular and graphical formats where applicable. Statistical significance was considered at $p < .05$.

Ethical Considerations

Ethical approval was obtained from the hospital administration prior to data collection. Participant confidentiality was strictly maintained, and no personal identifiers were recorded. Data were used solely for academic and research purposes in accordance with ethical guidelines.

Study Limitations

Limitations included a relatively small sample size, single-center setting limiting generalizability, and the use of convenience sampling, which may introduce selection bias. Additionally, the possibility of false-positive or false-negative UPT results could not be entirely excluded.

Result

This chapter presents the statistical findings of the study investigating the association between routine urinalysis parameters and urine pregnancy test outcomes among women of reproductive age. The results are reported using descriptive statistics, chi-square analysis, and Spearman correlation to determine the relationship between variables.

Descriptive Characteristics of the Study Population

A total of 100 females of reproductive age (15–49 years) were included in this cross-sectional study. The mean age was 33.35 ± 10.78 years. Of the participants, 42% were UPT positive and 58% were UPT negative. The most common final diagnosis was urinary tract infection (UTI) without pregnancy (52%), followed by UTI with pregnancy (39%), while only a small proportion represented normal or complicated pregnancy outcomes.

Table 4.1: ***Descriptive Statistics of Study Variables (N = 100)***

Variable	Mean	SD	Median	Min	Max
Age (years)	33.35	10.78	34	15	49
Specific Gravity	1.016	0.009	1.015	1.005	1.030
pH	6.46	1.02	6.5	5	8
Protein	1.93	1.32	2	0	4
Glucose	1.49	1.08	2	0	3
Ketones	1.10	0.81	1	0	2
Blood	1.63	1.12	2	0	3
Leukocyte Esterase	2.05	1.38	2	0	4
RBC /HPF	2.14	1.40	2	0	4
WBC /HPF	2.11	1.53	2	0	4

Note. *HPF = high power field; SD = standard deviation.*

Table 4.1 presents the distribution of demographic and urinalysis parameters. Overall, moderate variability was observed in urinary biochemical and microscopic findings, indicating the presence of both normal and abnormal urinary profiles within the study population.

Distribution of Urine Pregnancy Test Results

Table 4.2: ***Distribution of UPT Results Among Participants***

UPT Result	Frequency (n)	Percentage (%)
Positive	42	42%
Negative	58	58%

Note. *UPT = urine pregnancy test.*

Table 4.2 shows that 42% of participants tested positive for pregnancy, while 58% were negative, indicating a relatively balanced distribution of reproductive and non-reproductive cases within the study sample.

Association Between RUE Parameters and UPT Results

Table 4.3: ***Chi-Square and Fisher's Exact Test for Association Between Urinalysis Parameters and UPT***

Variable	χ^2	df	p-value	Odds Ratio	Interpretation
Nitrite	0.312	1	0.577	1.257	Not significant
Amenorrhea	13.826	1	0.0002	5.682	**Significant**
Proteinuria	0.378	1	0.539	1.404	Not significant
Glucosuria	2.135	1	0.144	2.073	Not significant
Leukocyte Esterase	0.215	1	0.643	0.781	Not significant
Hematuria	0.008	1	0.929	0.957	Not significant
Ketonuria	0.118	1	0.732	1.169	Not significant
Bacteriuria	1.126	1	0.289	0.628	Not significant
WBC >5/HPF	0.148	1	0.701	1.170	Not significant
RBC >5/HPF	0.045	1	0.832	1.090	Not significant

Note. *Significance level set at $p < .05$.*

Table 4.3 demonstrates that no routine urinalysis parameter showed a statistically significant association with urine pregnancy test results except amenorrhea (p = 0.0002). Women with amenorrhea were significantly more likely to test positive for pregnancy, with an odds ratio of 5.68, indicating a strong association. All biochemical and microscopic urine abnormalities showed no meaningful association with UPT outcomes.

Correlation Between RUE Parameters and UPT Results

Table 4.4: ***Spearman Rank Correlation Analysis***

Variable	ρ	p-value	Interpretation
Age	-0.113	0.265	Not significant
Specific Gravity	0.086	0.397	Not significant
pH	0.028	0.784	Not significant
Protein	0.038	0.704	Not significant
Glucose	0.138	0.171	Not significant
Ketones	0.046	0.653	Not significant
Blood	0.032	0.755	Not significant
Leukocyte Esterase	-0.046	0.650	Not significant
Nitrite	0.056	0.581	Not significant
RBC	0.093	0.358	Not significant
WBC	0.056	0.579	Not significant
Bacteria	0.106	0.383	Not significant

Note. *ρ = Spearman correlation coefficient.*

Table 4.4 confirms that all correlations between routine urinalysis parameters and UPT results were negligible and statistically non-significant. This indicates that urinalysis findings do not meaningfully predict or influence urine pregnancy test outcomes.

Summary of Key Findings

- 42% of participants were pregnancy positive.
- Only amenorrhea showed a significant association with UPT results.
- All urinalysis biochemical and microscopic parameters showed no significant relationship with pregnancy status.
- Correlation analysis confirmed absence of meaningful association between RUE and UPT outcomes.

DISCUSSION

This study aimed to determine whether routine urine examination (RUE) findings could serve as a predictor or correlate of urine pregnancy test (UPT) results among females of reproductive age. The findings demonstrated that routine urinalysis parameters, including dipstick chemistry and microscopic urine findings, showed no statistically significant association with pregnancy status. The overall high prevalence of urinary tract infection (UTI) features observed in the study population (91% of participants showing at least one abnormal urinary parameter) reflects the established clinical understanding that UTIs are highly prevalent among women of reproductive age and are not specifically linked to pregnancy status.

Statistical analysis using Spearman's correlation further confirmed the absence of meaningful relationships between individual urinalysis components and UPT results, with all correlation coefficients remaining below 0.15 and statistically non-significant. This consistently weak association suggests that urinary biochemical and microscopic changes do not reflect pregnancy status in a clinically useful manner. In settings where UTI prevalence is high, urinalysis findings become more representative of infectious or inflammatory conditions rather than reproductive state, reinforcing that RUE cannot function as a surrogate marker for pregnancy detection.

The only statistically significant association observed in this study was between amenorrhea and positive UPT results (OR = 5.68, $p < .001$). This finding is clinically expected, as amenorrhea remains one of the most reliable early indicators of pregnancy and is commonly the primary reason for initiating pregnancy testing. Women presenting with amenorrhea were nearly six times more likely to test positive for pregnancy, underscoring the continued importance of menstrual history in clinical decision-making.

Interestingly, none of the individual urinalysis parameters—including proteinuria, glucosuria, ketonuria, hematuria, leukocyte esterase, nitrite positivity, or microscopic indicators such as RBCs, WBCs, and bacteriuria—showed a significant correlation with UPT outcomes. Although physiological pregnancy is known to induce renal adaptations such as increased glomerular filtration rate and mild protein excretion, these changes were not significantly reflected in the current cohort. This may be attributed to the predominance of early gestational stages in the study population, during which physiological renal and metabolic alterations are often too subtle to produce detectable changes in routine dipstick or microscopic analysis.

Overall, these findings reinforce the diagnostic distinction between urinary infection markers and pregnancy detection. While urinalysis remains essential for identifying UTIs and renal abnormalities, it does not provide reliable evidence for pregnancy status. Immunoassay-based UPT, therefore, remains the appropriate diagnostic standard for pregnancy confirmation.

This study concludes that routine urine examination parameters—including dipstick analysis (protein, glucose, ketones, blood, leukocyte esterase, and nitrite) and microscopic findings (RBCs, WBCs, casts, and bacteria)—do not show a statistically significant association with urine pregnancy test results among females of reproductive age. These findings indicate that urinalysis is not a reliable tool for predicting or indicating pregnancy status.

Amenorrhea was the only variable significantly associated with a positive UPT result, confirming that menstrual history remains the strongest clinical predictor for initiating pregnancy testing. The high prevalence of urinary tract infection findings in both pregnant and non-pregnant participants further highlights that urinary abnormalities are common in this population and should be interpreted independently of pregnancy status.

In clinical practice, these results support the continued use of immunological urine pregnancy testing as the gold standard for pregnancy detection and caution against relying on routine urinalysis as an indirect indicator of pregnancy. Future large-scale, multi-center studies are recommended to further explore potential interactions between urinary biomarkers, infection status, and different stages of pregnancy to strengthen diagnostic accuracy and clinical interpretation.

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