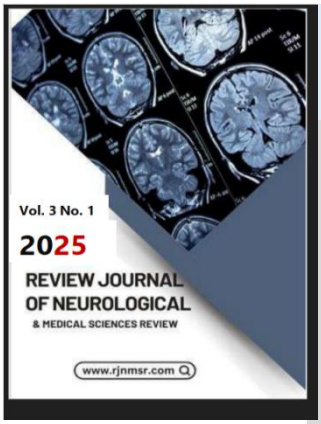

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Prevalence and Types of Abnormal Findings in Routine Urinalysis: A Retrospective Study from a Pathology Laboratory in Abbottabad

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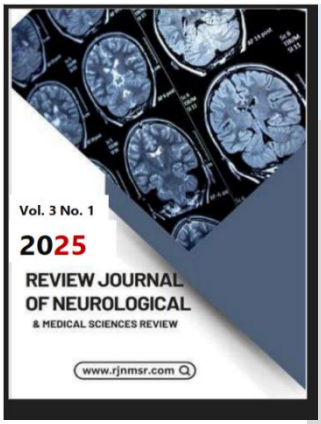

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Abstract

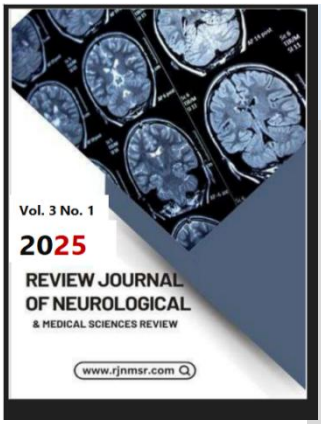
Urinalysis is a widely used, non-invasive diagnostic tool that plays a vital role in identifying various health conditions, including urinary tract infections, diabetes, and kidney disorders. Despite its routine use, the prevalence and patterns of abnormal findings in urine tests remain underreported in many local clinical settings. This study aimed to evaluate the prevalence and types of abnormalities found in routine urine examination (R/E) tests conducted in a private pathology laboratory in Abbottabad, Pakistan, and to explore their diagnostic relevance across different age and gender groups. A prospective study was conducted over a four-month period (March–June 2024) in a pathology laboratory near District Headquarters Hospital, Abbottabad. A total of 5400 urine samples were analyzed using standard urine dipsticks and microscopic examination. Data were recorded using a structured proforma, which included patient demographics, clinical history, and test results. Out of 5400 samples, abnormal findings were observed in 26.8% of cases. Females constituted 63.3% of the study population, with pregnant women accounting for 5.4%. Among these, 9.2% were found to have urinary tract infections. The most common abnormalities included dark urine (12.7%), proteinuria (16.2%), pyuria (18.6%), and hematuria (12.5%). Less frequent findings were glycosuria (5.3%), ketonuria (2.6%), and bilirubinuria (0.03%). This study highlights the significant diagnostic value of routine urine analysis in detecting a range of health issues. The findings underscore the importance of standardized testing protocols and regular screening, particularly among females and pregnant women, to support early diagnosis and effective patient management.

Keywords: Urinalysis, Routine Examination, Urinary Tract Infection, Proteinuria, Pathology Laboratory

Introduction

Urine analysis, or urinalysis, is a fundamental diagnostic tool routinely employed in clinical and laboratory settings to detect a wide range of health conditions. As a non-invasive, cost-effective, and readily accessible test, it provides critical information about a patient's metabolic, renal, and systemic health. It is especially useful in the early detection and monitoring of conditions such as urinary tract infections (UTIs), diabetes mellitus, kidney diseases, and hepatic disorders .

Urinalysis involves the examination of physical, chemical, and microscopic properties of urine. These include parameters such as color, clarity, specific gravity, proteins, glucose, ketones, bilirubin, hematuria, leukocytes, and more . Abnormal findings often serve as early indicators of underlying pathological changes, making urinalysis an essential part of routine diagnostic workups . Despite its importance, there are challenges and variations in the accuracy and efficiency of urine analysis across different pathology laboratories . This research aims to evaluate current practices, identify challenges, and assess diagnostic outcomes of urine analysis in pathology laboratories, providing insights that could enhance diagnostic protocols and healthcare delivery. Historically, urine has been used as a diagnostic indicator for centuries, with ancient physicians observing its color and smell to assess health



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status . Modern advancements have led to the development of urine dipsticks and automated analyzers, which improve both the speed and accuracy of detection.

Globally, numerous studies have underscored the diagnostic utility of urine analysis, demonstrated the high sensitivity and specificity of urine dipstick tests in detecting urinary tract infections (UTIs) . Another study by Maina et al. (2023) emphasized the role of urine analysis in monitoring chronic kidney diseases and metabolic disorders . These studies highlight the test's value in early disease detection and ongoing health monitoring. In developing regions, including Pakistan, diagnostic services face significant challenges such as inadequate resources, lack of standardized protocols, and limited access to advanced diagnostic tools . These issues can compromise the accuracy and reliability of urinalysis, leading to potential misdiagnoses and delayed treatments . Moreover, the rising prevalence of diseases like diabetes and hypertension in these regions increases the burden on healthcare systems . Studies have revealed notable variations in the diagnostic accuracy of urine analysis across different laboratories . Ain et al. (2024) reported significant discrepancies in the detection rates of abnormal urine components among pathology laboratories, suggesting a need for standardized protocols and improved quality control measures . Such variations can lead to inconsistent diagnostic outcomes, affecting patient care and treatment .

Although technologies like automated urine analyzers have the potential to transform laboratory diagnostics by minimizing human error and enhancing efficiency, their implementation is still limited in many low-income settings due to financial and infrastructural constraints. Given this backdrop, the present study aims to evaluate the prevalence and types of abnormal findings in routine urinalysis performed in a private pathology laboratory in Abbottabad, Pakistan. By analyzing a large and diverse sample set, the study seeks to provide insight into the diagnostic value of urine R/E (routine examination) in real-world clinical practice and highlight areas for improving laboratory diagnostics.

Materials and Methods

This prospective observational study was conducted at a private pathology laboratory located near the District Headquarters Hospital in Abbottabad, Pakistan. The study spanned four months, from March 1 to June 30, 2024. All urine samples received during this period were included in the analysis, total 5400 samples from patients aged between infancy to 80 years.

Sample Collection and Handling

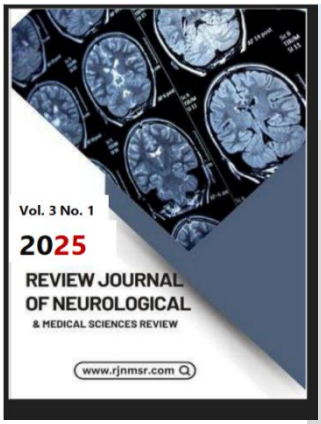
Patients were instructed to provide a midstream urine sample of approximately 30 mL in a sterile container. Each sample was submitted along with a completed requisition form that included basic demographic details and relevant clinical history. To ensure accurate results, all samples were processed within two hours of collection.

Urinalysis Procedure

Urine samples underwent both macroscopic and microscopic analysis:

Physical Examination: The color and clarity of each sample were assessed visually.

Chemical Examination: Urine reagent strips (10-parameter test strips) were used to detect the presence of proteins, glucose, ketones, bilirubin, and blood.



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Microscopic Examination

After centrifugation at 1500 rpm for 5 minutes, the supernatant was carefully discarded. The sediment was resuspended and examined under a light microscope at 10x and 40x magnification. Parameters assessed included white blood cells (pyuria), red blood cells (hematuria), epithelial cells, crystals, and casts.

Pregnancy Testing

In women of reproductive age, human chorionic gonadotropin (HCG) tests were performed to identify pregnancy-related cases. Any samples from confirmed pregnant individuals were noted for subgroup analysis.

Data Collection and Analysis

All findings, including physical characteristics, chemical test results, and microscopic observations, were documented in a structured proforma. Demographic data such as age, gender, and pregnancy status were also recorded. The results were categorized to determine the prevalence and types of abnormalities. Data were analyzed descriptively using percentages and frequencies.

Ethical Considerations

The study was conducted in accordance with ethical guidelines. Since patient data were de-identified and no direct patient interaction occurred, formal ethical approval was not required. However, confidentiality and data protection were strictly maintained.

Results

This study included patients up to 80 years old, with females comprising 63.3% of the sample pool. Pregnant women accounted for 5.4% of the study population, with 9.2% of them having urinary tract infections. Abnormalities were found in 26.8% of the samples. Physical examination revealed abnormal urine characteristics, including dark urine (30.7%) and hazy urine (17.4%). Laboratory tests detected proteinuria (16.2%), glycosuria (5.3%), ketonuria (2.6%), and bilirubinuria (0.03%). Furthermore, pyuria (18.6%), hematuria (12.5%), and bacteriuria (6.8%) were also observed.

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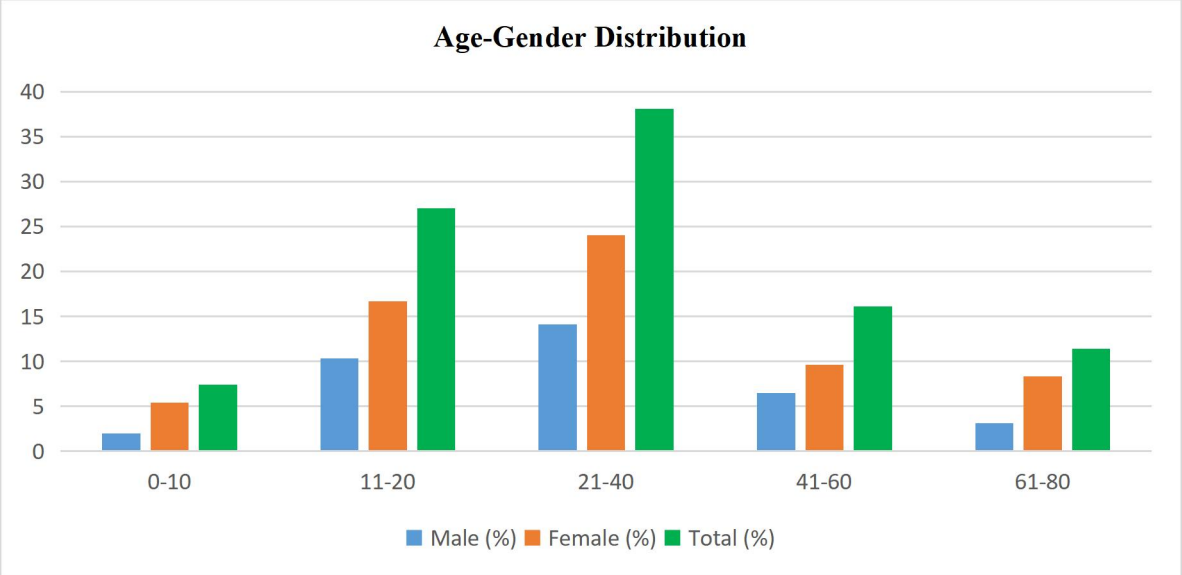


Figure 1: Age-Gender Distribution of the Study Participants

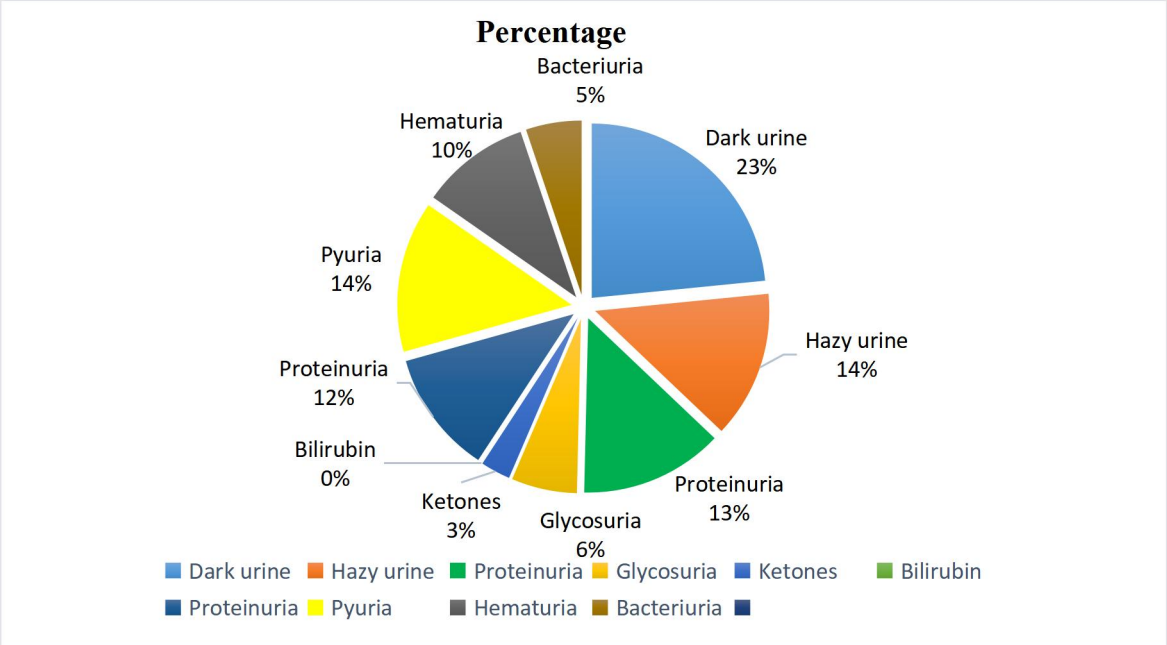
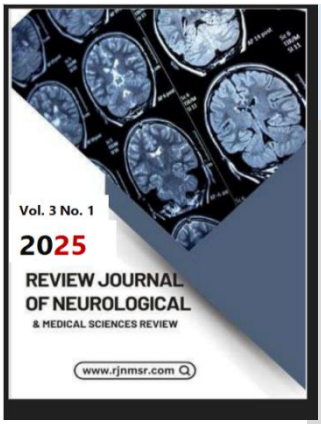


Figure 2: Physical, Chemical and Microscopic Analysis of Urine

Discussion

The percentage of positive urine RE tests was found to be reasonably acceptable, given the combined efforts of patients and laboratory staff. By conducting thorough inquiries, physicians can help minimize false positive results, which may further decrease the overall number of positive tests. In many cases, the abnormalities identified in urine screening tests are fleeting or caused by false positives, highlighting the need for cautious interpretation. Reagent test strips offer a



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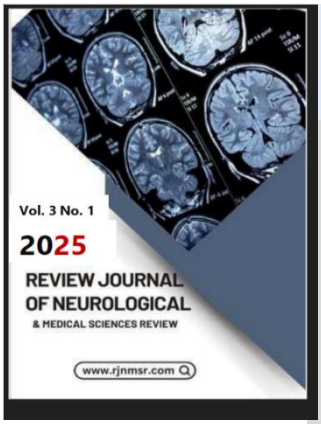
convenient and rapid method for urinalysis, enabling efficient assessment of kidney function. Our study spanned patients up to 80 years old, with a predominance of female patients (63.3%) contributing to the sample pool. The higher proportion of positive results among females can be attributed to the antenatal screening protocol, which necessitates more frequent testing. Moreover, females are more susceptible to urinary tract infections due to their anatomical features, including a shorter urethra and closer proximity to the anus and vagina, increasing their risk of infection . The prevalence of abnormal findings in our study was 26.8%, which is comparable to the results reported by Rawat et al., who found a 31.4% incidence of abnormal findings. Notably, the oldest age group, despite having the fewest patients, exhibited the highest percentage of positive results. Conversely, the lowest percentage of positive tests was observed in children, likely due to the challenges associated with collecting sufficient urine samples from this age group .

The physical examination of urine samples in our study showed that 12.7% had dark urine, similar to the 30.7% reported by Rawat et al. .Dark urine can be a sign of dehydration, while cloudy or turbid urine may indicate the presence of pus, protein, or white cells, requiring further evaluation. Furthermore, proteinuria was observed in 16.2% of samples, consistent with the 7.1% reported by Rawat et al. . Proteinuria can occur in healthy individuals due to various factors, including exercise, concentrated urine, fever, or extreme emotional stress . Glycosuria was detected in 3.3% of our study samples, aligning with the findings of Rawat et al. and Yasmin , who reported a 5.3% incidence. The presence of glucose in urine can be an indicator of diabetes mellitus, but it can also arise from other factors, including pregnancy, physiological stress, or corticosteroid use. This underscores the need for a comprehensive clinical evaluation to accurately interpret glycosuria results . Ketones were present in 1.5% of our study's urine samples, recognizable by their characteristic fruity smell. This indicates an abnormal breakdown of fat, potentially due to prolonged vomiting, fasting, starvation, or uncontrolled diabetes mellitus. Furthermore, our study revealed bilirubin in 0.003% of samples, aligning with Rawat et al. and Yasmin findings of 0.03% positive bilirubin results. The presence of bilirubin in urine may signal liver disease or biliary obstruction, necessitating additional evaluation . Pyuria was detected in 7.6% of our study samples, aligning with the results of Rawat et al. and Yasmin , who found a 18.6% incidence of pyuria. A characteristic "fishy" smell often accompanies pyuria, indicating the presence of an infection. This emphasizes the significance of pyuria as a diagnostic indicator of infection . Hematuria was observed in 5.5% of our study samples, aligning with the results of Rawat et al. and Yasmin , who found a 12.5% incidence of hematuria. The presence of blood in urine is a significant finding, as it can be associated with various urinary tract problems, including cancers, renal damage, and stones. Nevertheless, transient microscopic hematuria can be caused by non-pathological factors, such as vigorous exercise, sexual activity, trauma, rectal or prostate examination, and menstrual contamination . In our study, 5.4% of the participants were pregnant women, and among them, 9.2% had urinary tract infections (UTIs). This finding is consistent with the results of Rawat et al. and Yasmin , who reported a 6.7%



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prevalence of pregnant women and a 10% UTI rate among this group. The similarity in findings highlights the importance of monitoring and managing UTIs in pregnant women to prevent potential complications.

Conclusion

This study reinforces the clinical value of routine urinalysis as a cost-effective, non-invasive, and informative diagnostic tool. Through the analysis of 5400 urine samples, a significant proportion (26.8%) exhibited abnormal findings, with pyuria, proteinuria, and hematuria being the most prevalent indicators. These abnormalities were notably higher among female patients, particularly those of reproductive age and pregnant women, underscoring the importance of targeted screening in this population. The detection of key biomarkers such as protein, glucose, leukocytes, ketones, and red blood cells plays a critical role in the early diagnosis and management of a wide range of conditions including urinary tract infections, diabetes mellitus, renal diseases, liver dysfunction, and urological malignancies. Notably, the frequent observation of pyuria highlights its utility as a marker for underlying infections, especially in settings where access to culture facilities may be limited. Given the burden of non-communicable diseases and infections in developing countries, this study advocates for the standardization and integration of urinalysis in routine clinical practice, particularly for high-risk groups. Furthermore, enhancing laboratory infrastructure, adopting automated technologies, and training personnel could significantly improve diagnostic accuracy and patient outcomes. Future research should focus on correlating urinalysis findings with clinical diagnoses and patient follow-up data to further validate its predictive utility in diverse healthcare settings.

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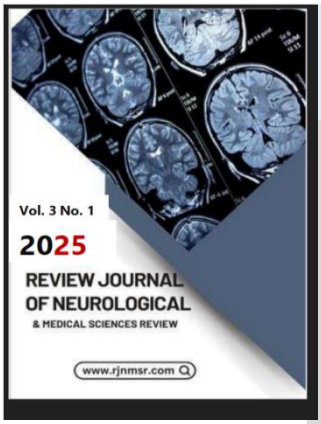

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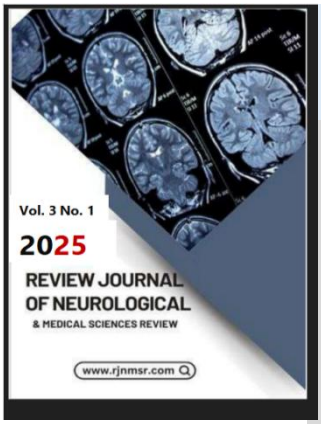

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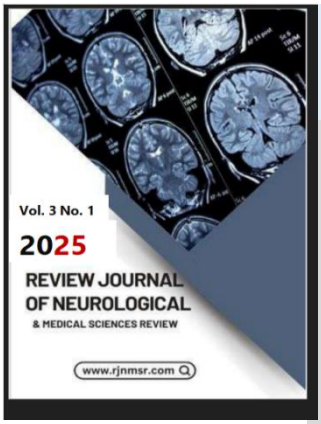

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