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COMPARATIVE STUDY OF AUTOMATED AND MANUAL URINE ANALYSIS METHODS: A COMPREHENSIVE REVIEW

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ABSTRACT

Urinalysis is a fundamental diagnostic test widely used for screening and monitoring renal and systemic diseases. Manual urine analysis has traditionally been considered the gold standard, but it is labor-intensive and subject to observer variability. Automated urine analyzers have emerged to improve efficiency, standardization, and reproducibility. This review compares both methods in terms of accuracy, performance, advantages, and limitations, highlighting the importance of a combined diagnostic approach.

INTRODUCTION

Urinalysis is commonly used in clinical laboratories to detect urinary tract infections, kidney disorders, and metabolic diseases. It includes physical, chemical, and microscopic examination. Manual methods rely heavily on trained personnel, while automation offers faster and standardized results.

Manual Urine Analysis

Manual urinalysis involves visual examination, dipstick testing, and microscopic evaluation after centrifugation. It allows identification of red blood cells, white blood cells, casts, crystals, and microorganisms. However, results depend on operator skill and experience.

Automated Urine Analysis

Automated systems use technologies such as flow cytometry, digital imaging, and reflectance photometry. These analyzers process large numbers of samples quickly and provide standardized results with minimal human intervention.

Comparative Performance

Automated analyzers show good correlation with manual methods for common parameters such as RBCs and WBCs. However, discrepancies exist in detecting casts and rare elements. Manual microscopy remains essential for confirmation.

Advantages and Limitations

Automation improves speed, reproducibility, and workflow efficiency, while manual analysis provides better morphological detail. Each method has strengths and limitations, making their combined use ideal.

CONCLUSION

A hybrid approach combining automated screening and manual confirmation ensures optimal diagnostic accuracy. Automation enhances efficiency, while manual methods remain indispensable for detailed evaluation.

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