

Evaluation of a Fully Automated Walk-Away System for Clinical Mass Spectrometry Sample Preparation

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Introduction

Sample preparation is a critical bottleneck in clinical mass spectrometry workflow due to high labour demand, time consumption, and susceptibility to manual errors.

The aim of this study was to evaluate the performance and clinical laboratory suitability of a fully-automated sample preparation system (AUTOMAN ELITE) which has been designed to enable walk-away processing for LC-MS/MS applications used in the clinical laboratory.

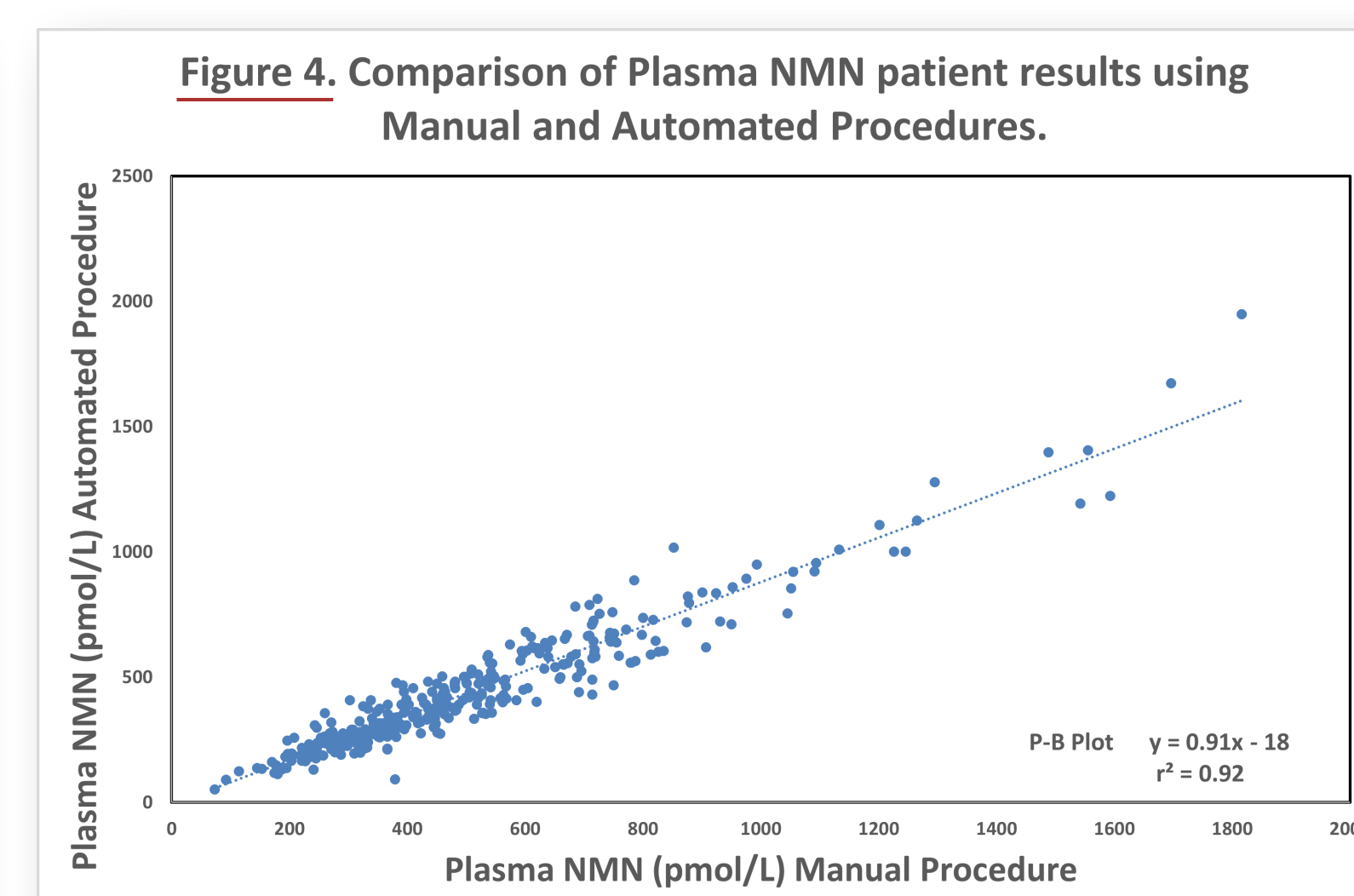
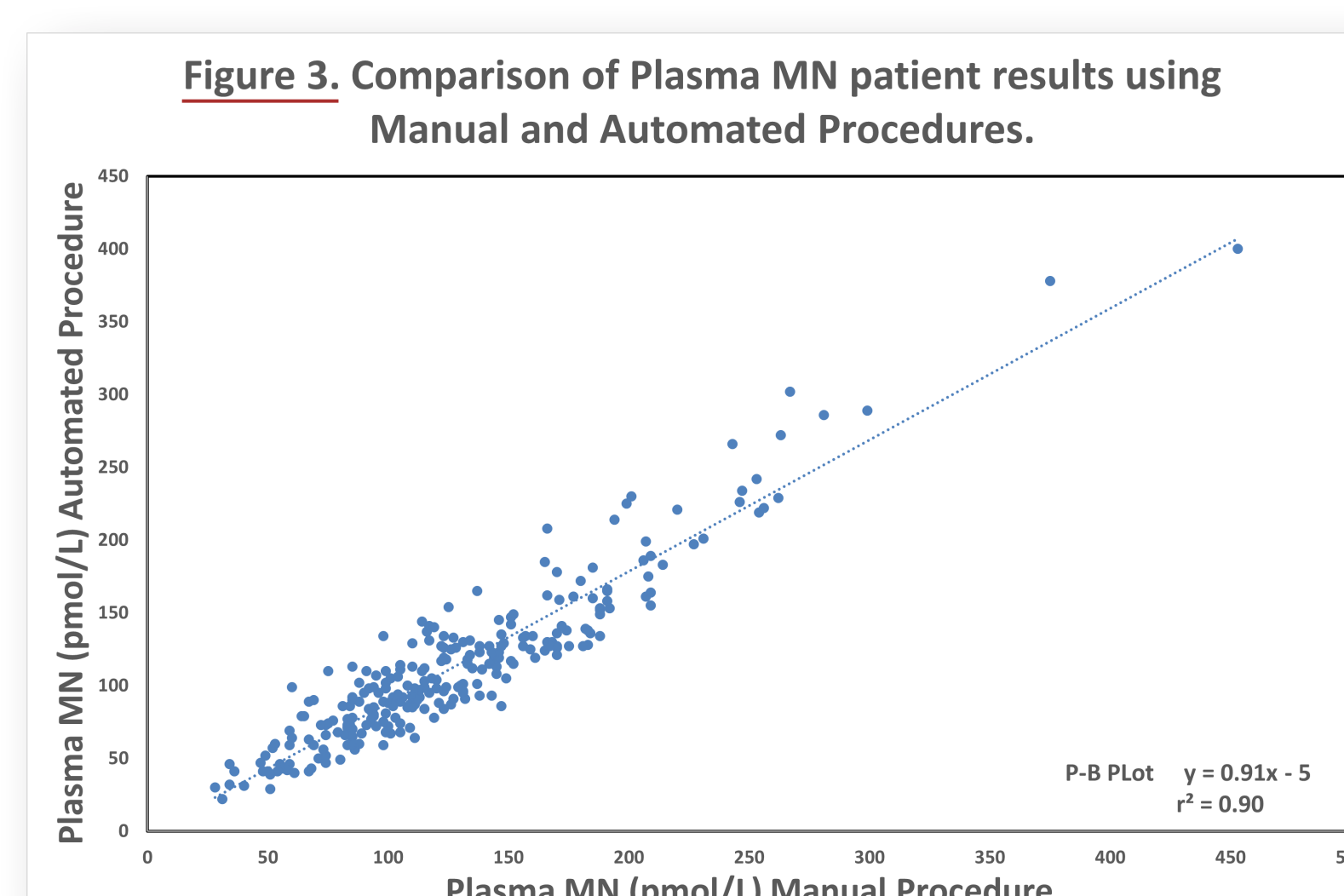
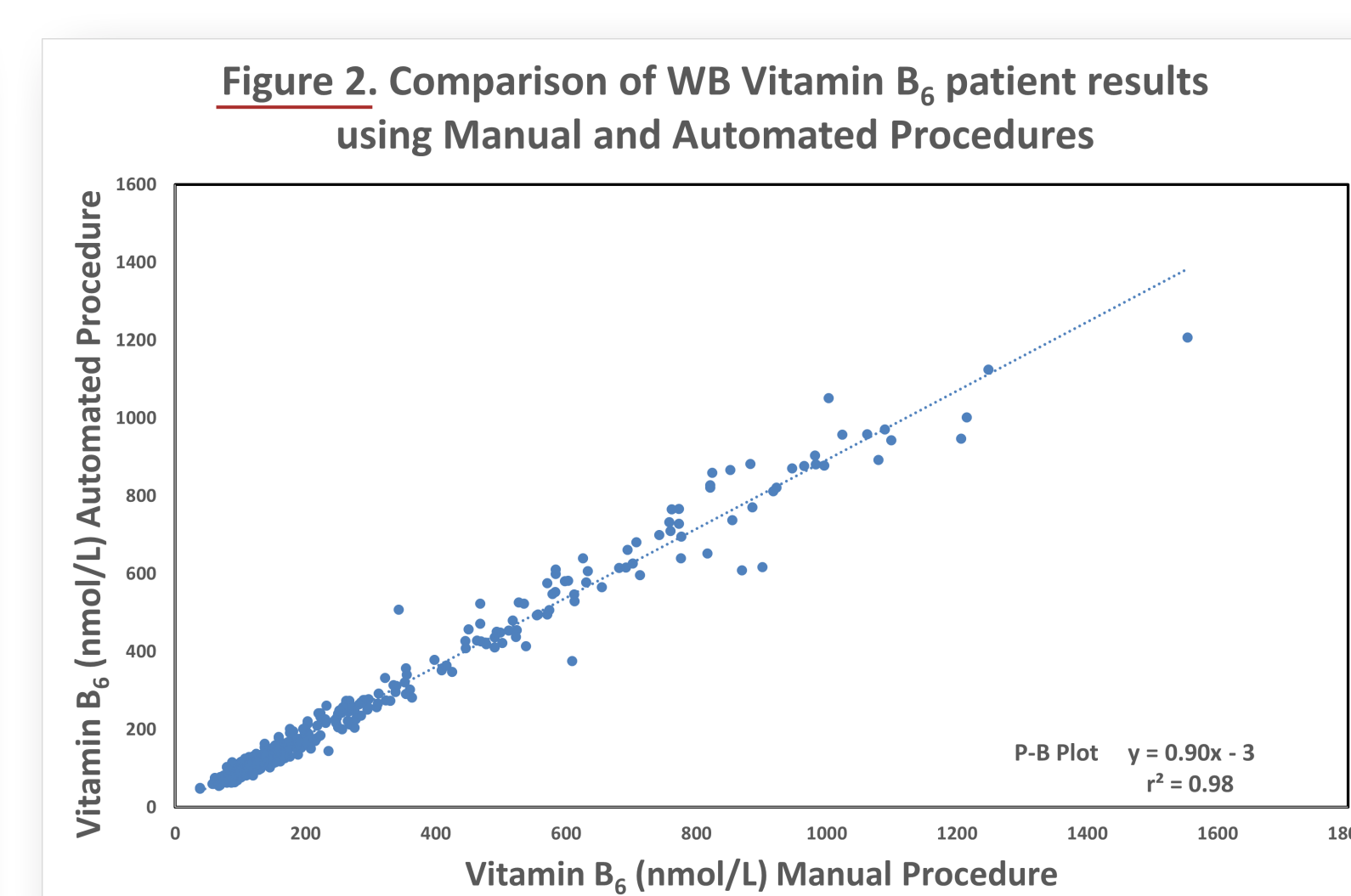
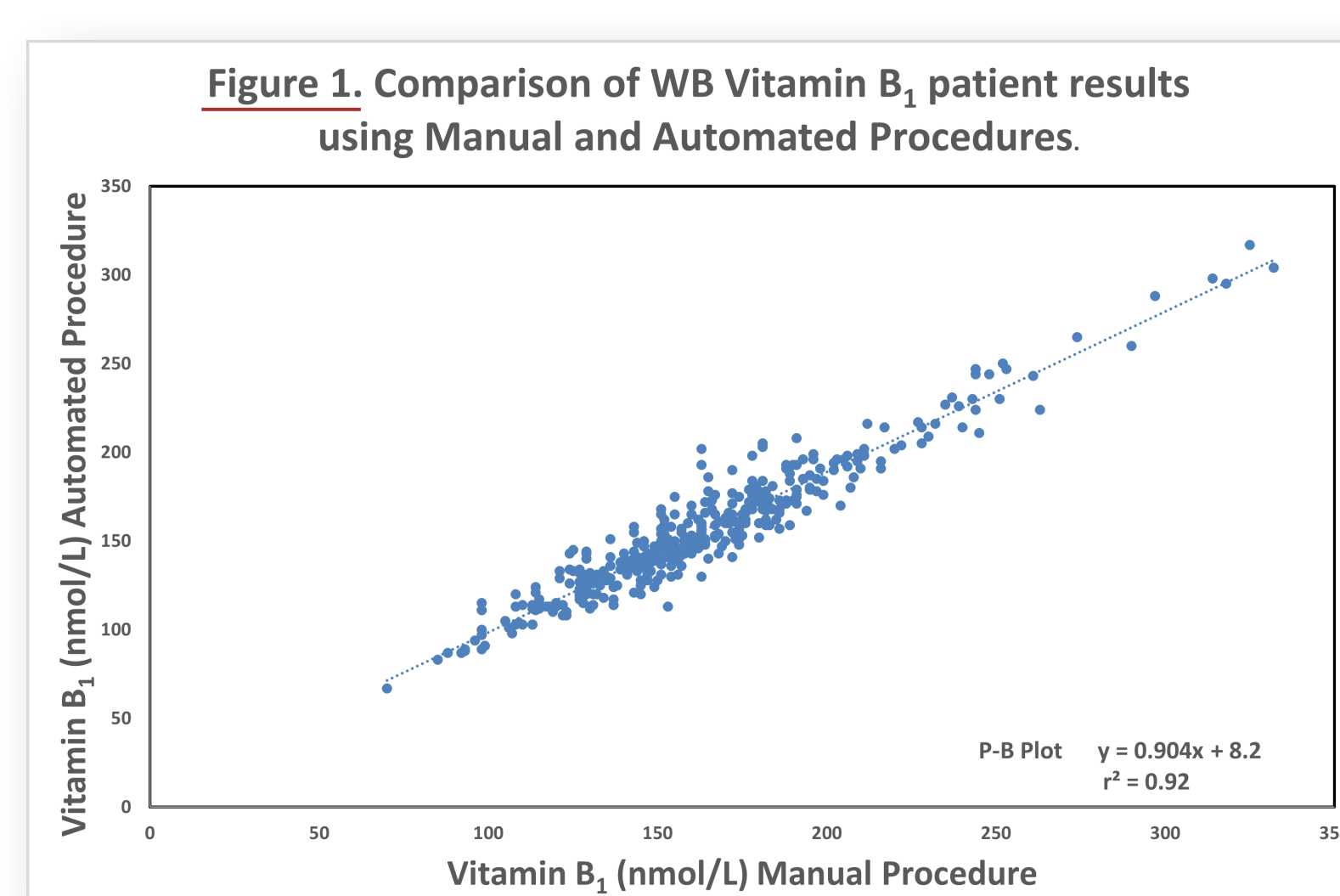
Methods

The AUTOMAN ELITE system integrates barcode scanning, pipetting, heating, shaking, derivatization, positive-pressure filtration, nitrogen evaporation, and microplate centrifugation into a single workflow.

- All components of the system were tested and compared against manual sample preparation using validated methods for whole blood (WB) Vitamin B1, Vitamin B6 and the plasma free metanephries namely metanephrene (MN) and normetanephrene (NMN).
- Each method was evaluated using internal quality control, EQA samples and patient samples.
- Passing-Bablok (P-B) was used for regression analysis.
- The study assessed total hands-on time for each step, method comparison, and reproducibility (CV%). System throughput, ease of use, and reagent compatibility were also assessed.

Results

- Whole blood Vitamin B1 and B6 results for automated and manual pretreatment procedures for 540 patient samples were in agreement (Figure 1 and Figure 2).
- Inter-assay imprecision (%CV) was < 3.9% for WB Vitamin B1 and < 5.8% for Vitamin B6.
- For 96 samples the fully-automated system reduced sample preparation time for WB Vitamin B1 and B6 from 200 minutes to 135 minutes.
- A total of 318 and 344 patient samples were evaluated for plasma free MN and NMN respectively. P-B regression plots demonstrated good correlation (Figure 3 and Figure 4).
- Inter-assay imprecision (%CV) was < 5.6% for all plasma free metanephries.
- For 96 samples the fully-automated system reduced sample preparation time for plasma free metanephries from 6 hours to 3 hours (50%).
- No cross-contamination was observed across replicate batches.
- Method programming and run initiation were user-friendly and required minimal technical training.
- The automated workflow successfully replicated all steps of complex manual procedures including pipetting, mixing, centrifuge, and drying, with consistent recovery and signal intensity.
- The data indicated that there was good agreement between the LC-MS/MS results for the manual and automated methods.



Conclusions

- AUTOMAN ELITE demonstrated robust, reproducible, and scalable performance for clinical mass spectrometry sample preparation.
- The all-in-one modular design and compatibility with diverse reagents provides a solution for clinical laboratories seeking to reduce human error, standardise operations, and expand LC-MS/MS testing capacity while maintaining acceptable analytical performance.

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AUTOMAN ELITE



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