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17. Evaluation of the Lumipulse® G 25-OH Vitamin D assay

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Introduction Reliable 25(OH)vitamin D (25(OH)D) assays are essential for measuring the vitamin D status. Fujirebio introduced in 2013 the Lumipulse® G 25-OH Vitamin D assay, using a novel sandwich assay concept. We tested its precision and linearity, imprecision profile and its correlation with a calibrated LC-MS/MS method as well as two other commercially available 25(OH)D immunoassays (from Abbott and Beckman).

Methods A CLSI-EP10 protocol (5 days, 2 runs per day) and BioRad Immunoassay Special 1 and 3 controls were used for basic precision and linearity testing of Fujirebio's method. Method correlation using a CLSI-EP9 protocol was performed with 60 left-over human serum samples, from a mixed population of clinical outpatients and general practitioner patients collected in Meander Medisch Centrum. Samples were split, coded, send on dry ice to external sites where they remained frozen until analyses. The Lumipulse G 25-OH Vitamin D kit was used as prescribed by Fujirebio Europe. Samples were run blinded on a LUMIPULSE® G600 II analyzer situated at Fujirebio Europe R&D. Vitamin D metabolites 25(OH)D3, 25(OH)D2 and 3-epi-25(OH)D3 were measured by a previously described LC-MS/MS method (ref 1) at the Canisius-Wilhelmina Ziekenhuis, Nijmegen. Its calibration was verified using the "Thienpont" reference serum panel for 25OHD (Ref!25OHD, LabQuality). Abbott Architect analyses were performed on a C16000 platform in Meander Medisch Centrum, Amersfoort. Beckman Access analyses were performed on a UniCel™ DxI 800 platform in Elkerliek Ziekenhuis, Helmond, the Netherlands. Precision plot and EP9 and EP10 calculations were performed using EP-Evaluator from Data Innovations.

Results

Correlation of total 25(OH)D (sum 25(OH)D3 and 25(OH)D2) of our LC-MS/MS method with LabQuality by Deming regression was excellent LC-MS/MS = 1.02 LabQuality – 2.0 (R=0.999; mean bias was -0.38 nmol/L), see Fig 1A. In the EP9 protocol the Lumipulse G assay correlated very well with LC-MS/MS by Deming regression: Lumipulse = 0.97 LC-MS/MS – 5.2 nmol/L; R=0.986 Fig 1B, with a mean bias of -7.5 nmol/l. Correlations for competitor assays are shown in Table 1 and Fig 1 C-D.

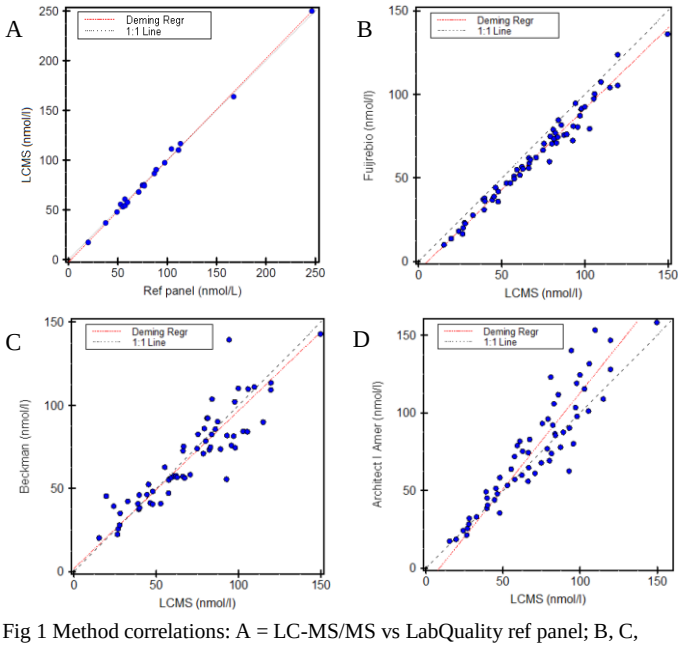

Fig 1 Method correlations: A = LC-MS/MS vs LabQuality ref panel; B, C, D = Fujirebio, Beckman, Abbott immunoassay vs LC-MS/MS, respectively.

Table 1 Slope and intercept (with 95% Confidence Interval), correlation coefficient R and mean bias (from Bland Altman plot) for the method correlations

Method	Deming correlation to reference (LC-MS/MS)	Slope C.I.	Intercept C.I.	Correlat Coef. R	Mean bias nmol/L
Fujirebio Lumipulse	Lumipulse (nmol/L) = 0.97 LC-MS/MS – 5.2	0.93 to 1.0	-8.4 to -1.0	0.986	-7.5
Beckman Access	Access (nmol/L) = 0.95 LC-MS/MS + 1.9	0.84 to1.06	-6.6 to 10.4	0.901	-1.8
Abbott Architect	Architect (nmol/L) = 1.24 LC-MS/MS – 10.8	1.11 to 1.37	-20.6 to -0.9	0.920	+ 6.0

LUMIPULSE® G600 II analyzer

Imprecision : For the Biorad Special Immunochemistry Controls 1 and 3 the declared summed content of 25(OH)D3 and 25(OH)D2 is 37 nmol/l and 191 nmol/L, respectively. Using the EP-10 protocol we found for Lumipulse a 'total' CV of 4.1 % at 37 nmol/l and 1.3% at 191 nmol/l. This fulfills the < 10 % CV precision demand for routine analysis of 25(OH)D3 (Stockl & Thienpont – ref 2).

Using a special set of 6 very low 25(OH)D3 samples, analysed by LC-MS/MS, we could estimate that the LOQ at 10 % CV is below 10 nmol/L (Fig 2), taking into account a 95% confidence interval.

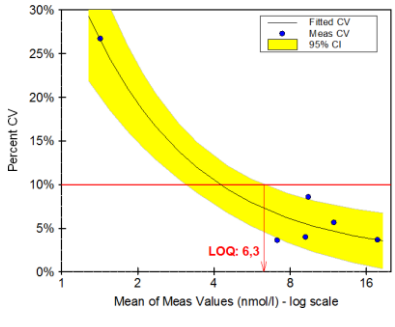

Fig 2 Precision profile for Fujirebio's assay

The assay passed the EP10 tests for non-linearity (t-score 2.3) and drift (t-score 2.6) using the BioRad Controls, which are partly prepared by standard addition.

References:

1) Van den Ouweland et al. J Chromatogr B 2014; 967: 195-202
2) Stockl, Sluss, Thienpont. Clin Chim Acta 2009; 408: 8–13

Conclusion

We found the new Fujirebio Lumipulse G 25-OH Vitamin D kit suitable for measuring total 25(OH)D in human serum. Reproducibility and correlation with LC-MS/MS were high and fulfill present standards. A correction for a small negative bias could be considered.

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