

Grenoble le 10 décembre 2003

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**Validation of the in-vitro-diagnostic-system Hemo_Control
Comparison with the Coulter LH 750 for measurement of
hemoglobin**

INTRODUCTION

The portable hemoglobinometer is an useful instrument to determine the haemoglobin concentration in different situations as for example in the operating theatre or to screen individuals for anemia in developing countries.

EKF-diagnostic GmbH has developed a new hemoglobinometer, Hemo_Control. This system requires only a small sample of capillary blood, is relatively inexpensive and easy to use and gives immediately digitaly displayed results.

The purpose of this study was i) to compare the hemoglobin concentration values using the Hemo_Control hemoglobinometer and a reference method such as the Coulter LH 750 and ii) to assess the agreement between these two methods.



METHODS

Measuring principle used in the Hemo_Control

The method is based on the photometric measurement of hemoglobin contained in whole blood after its conversion to its azide derivative by reagents present in the system's special capillary action microcuvette.

Subject samples

A venous sample was collected for each subject in a EDTA evacuated tube (Becton Dickinson), homogenized and tested by applying a drop of whole blood to the hydrophobic surface. The microcuvette is filled in one step by capillary action.

No duplicate measurements have been made with the Hemo_Control System.

Subject selection: the samples have been randomized among the different samples received by the Hematology Laboratory of the CHU of Grenoble. The study does not include the pediatric population.

153 blood samples have been measured by the Hemo_Control system and the reference method (Coulter LH 750).

Validation of the Hemo_Control System and comparison with the reference method

Repeatability (intra-day essay):

Three samples with high, middle and low concentration of hemoglobin were analyzed by the Hemo_Control System and each measure was repeated 10 times.

Reproductibility (inter-day essay):

To that purpose, we used the hemoglobin controls dedicated to the Hemo_Control System. They were analyzed at 10 different days. This also allowed to evaluate the stability of these controls.

Statistical analysis:

The statistical analysis was performed using the StatGraphics software except for the Bland and Altman test. The following parameters were assessed:

- normality
- linear regression
- correlation coefficient
- Student-test
- Measure of agreement: method of Bland and Altman

RESULTS

Repeatability and reproducibility

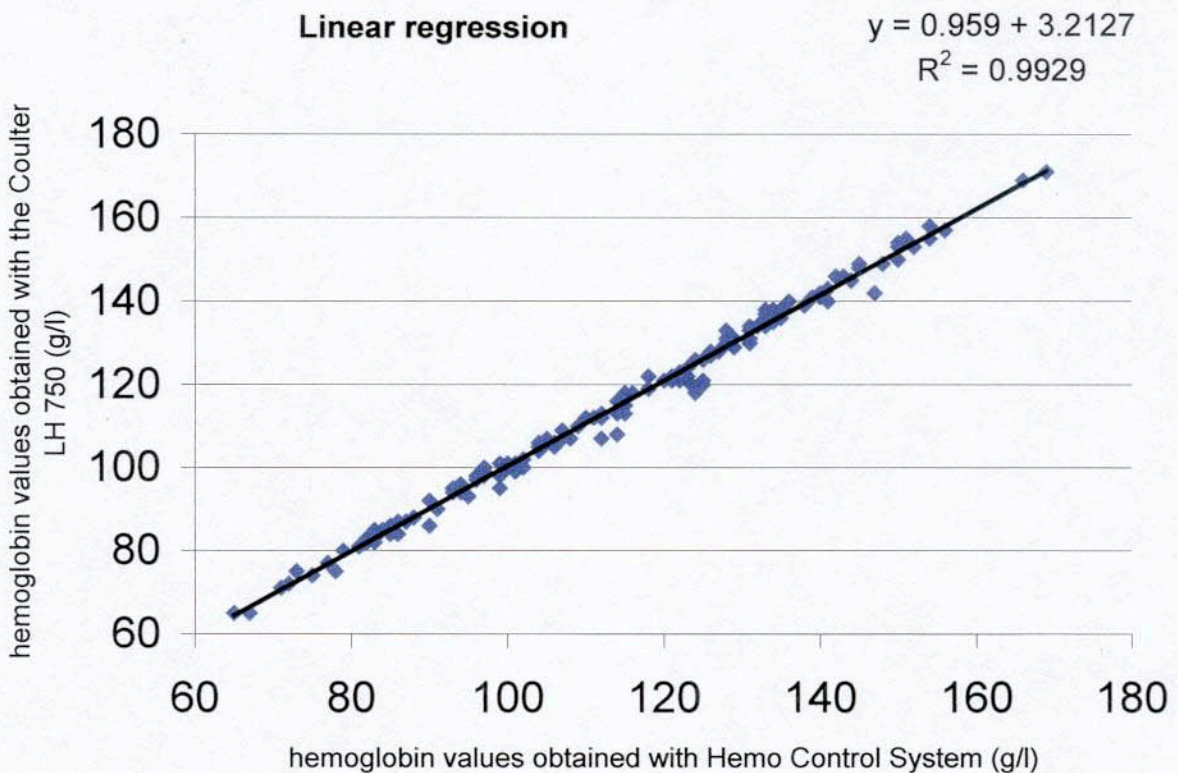
| | true values * Hb g/l | n = | mean | σ | precision CV % | accuracy % |
|--|-------------------------|-----|-------|----------|-------------------|---------------|
| Repeatability essays (within-day) | 64 | 10 | 64,6 | 0,699 | 1,1 | 0,9 |
| | 106 | 10 | 107,8 | 0,632 | 0,6 | 1,7 |
| | 150 | 10 | 152,7 | 1,059 | 0,7 | 1,8 |
| Reproducibility essays (between-day) | 120 | 10 | 116,2 | 0,919 | 0,8 | 3,1 |
| | 160 | 10 | 155,0 | 2,000 | 1,3 | 3,1 |

*The true values permitting to calculate the accuracy are the controls for the reproducibility assays and corresponds to the values obtained with the reference method (LH Coulter 750) for the repeatability assays

This results show low coefficient of variation (CV) and a very good accuracy since both coefficients are well bellow 5%.

Comparison with the reference method

- *Linear regression (fig 1):*



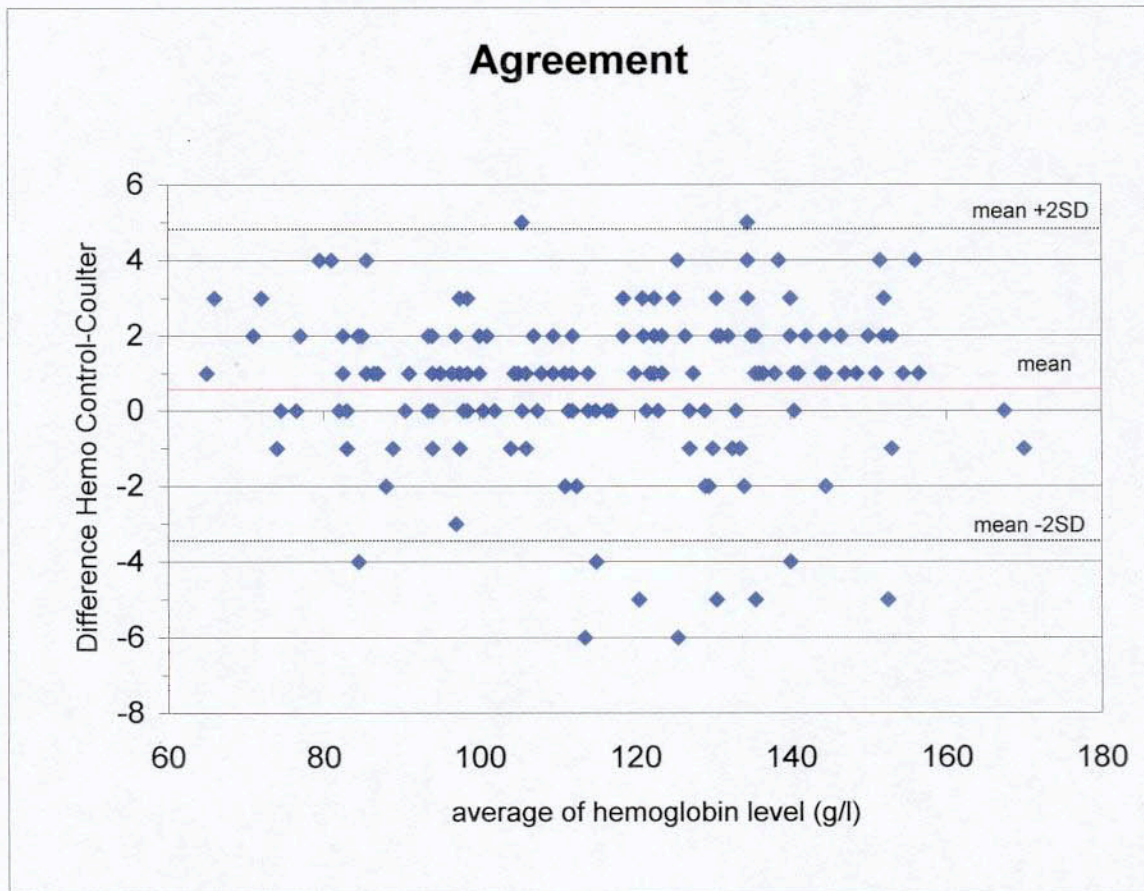
Correlation coefficient

| | | |
|--------------|--------------|------------|
| | Hemo_Control | Coulter LH |
| Hemo_Control | | 0,9964 |
| Coulter LH | 0,9964 | |

The correlation coefficient is high and measures the strength of relation between the 2 variables but neither correlation nor regression are the right tests to evaluate the agreement between two methods.

- *Measuring agreement (Bland and Altman)*

For the evaluation between assay methods, we need to investigate whether or not the two methods are clinically equivalent as previously discussed in the literature ¹⁻⁴. To that purpose we used the method developed by Bland and Altman ¹.



| | | |
|---------------------------|--------------------------|-----|
| Hemo_Control – Coulter LH | Mean of differences (Md) | SD |
| | 0,7 | 2,1 |

A bias of 0.7 g/L was found. This bias has no clinical significance and is a normal calibration difference between 2 devices.

The 95% confidence interval [-3,5; + 4,9] was calculated by $Md \pm 2SD$ and rounded to [-4 ; +5]. Most differences are expected to lay in that range¹. Our results show 6 points outside (4%) which is clinically acceptable. Therefore, we conclude that the Hemo_Control System is in good agreement with the reference method.

Conclusion

We can consider, using the Bland and Altman method¹ (Bland and Altman, 1986) that there is no clinically significant differences between the two methods.

References

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