

RELIABILITY AND REPRODUCIBILITY OF HAEMATOLOGICAL VARIABLES, INTER- AND INTRA-ANALYSER COMPARISON OF COULTER COUNTER AND HEMOCUE.

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Some degree of measurement error is always associated with any assessment technique. Atkinson and Nevill (1998) stated that reliability can be considered as the minimum acceptable error for the effective practical use of a testing procedure or assessment. Quantification of measurement errors and assessment of inter- and intra-analyser differences are critical in sports science research to assess the minimum differences required to infer statistical significance. Interclass correlation coefficients (ICC) confer information about reliability, but do not quantify the error magnitude. A useful tool to assess reliability proposed by Bland and Altman (1983) is the limits of agreement (95%LOA). Unlike other measures of reliability, usage of LOA requires exploration of systematic bias and assessment of scedasticity of the error data. This study investigated and quantified inter- and intra-reliability and reproducibility of haematological variables assessed using Act Diff Coulter counter (Coulter Electronics, UK) and Hemocue201 (HemocueAB, Sweden).

Individual blood samples (n=228) collected by standard venipuncture technique were assigned to three different groups. Group 1 (n=132) for intra-analyser comparison of haemoglobin (Hb) data using Coulter (C) and Hemocue (H) analysers. Group 2 (n=48) for inter-analyser comparison of Hb data using H. Group 3 (n=48) for inter-analyser comparison of haematological variables (Hb, RBC, WBC, MPV, MCH and Plt) using C. Measurement errors were quantified using ICC and 95%LOA, scedasticity was assessed using Pearson correlation coefficients.

Comparison of Hb data (n=132) between C and H revealed high reliability (ICC_{2,1} = 0.897), a small inter-analyser bias (C>H; mean bias 0.53 g.dL⁻¹) and 95% LOA of -0.08 to +1.15 g.dL⁻¹. Repeated Hb data (n=48) using H revealed high reliability (ICC_{3,1} = 0.982), a very small intra-analyser bias (-0.06 g.dL⁻¹) and 95% LOA of -0.43 to +0.30 g.dL⁻¹. Repeated Hb data (n=48) using C revealed high reliability (ICC_{3,1} = 0.986), minimal intra-analyser bias (-0.02 g.dL⁻¹) and 95% LOA of -0.31 to +0.35 g.dL⁻¹. High reliability (ICC_{3,1} > 0.970) were recorded for the additional haematological variables RBC, WBC, MPV, MCH and Plt assessed using C. For all assessed variables the error data were homoscedastic, inferring no relationship between the error measurement and the magnitude of the measured variable. In conclusion, data assessed using C or H were highly reliable and reproducible, however, a small significant (0.53g.dL⁻¹; P<0.001) inter-analyser bias was detected between C and H. The assessed 95%LOA for Hb data have implications for usage in the assessment of plasma volume (PV) changes; assuming 95%LOA for haematocrit data of -0.5 to +0.5%, then computed minimal detectable

%PV changes (Dill and Costill, 1974) would be 6.2 and 6.8% for C and H, respectively.

Atkinson and Nevill (1998) *Sports Med* 26, 217-238.

Bland and Altman (1983) *Lancet* 8, 307-310.

Dill and Costill (1974) *J Appl Physiol* 37, 247-248.

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