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Innovative Talk 3

MyVet and MyDoc – a laboratory in your phone

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Abstract

Background: Quantifying erythrocytes and leukocytes is crucial in veterinary diagnostics. Traditional methods like flow cytometry, laser scattering, and impedance detection, while accurate, require significant sample volumes and complex preparation. Emerging point-of-care (POC) technologies have identified visible-near infrared (Vis-NIR) spectroscopy as a promising, minimally invasive alternative. **Objective:** This study aims to establish direct correlations between blood cell counts (erythrocytes, leukocytes, hemoglobin, and hematocrit) and scattering coefficients from whole blood spectra, supporting the development of portable, reagent-free diagnostic tools for veterinary use. **Methods:** Fresh canine blood was collected via standard venipuncture at Anicura CHV - Veterinary Hospital Center. Spectral data were captured using a 4500K LED and Ocean Insight STS-vis spectrometer (300-800 nm). Scattering correction coefficients were calculated using an extended multiplicative scattering correction algorithm, and multivariate linear regression (MLR) models were used to assess the relationship between scattering data and hemogram parameters. Model performance was evaluated using Pearson correlation (R), mean absolute error percentage (MAPE), and coefficient of determination (R^2). **Results:** Fig. 1 presents the correlation plots for RBC, Hgb, HTC, and WBC, while Table 1 shows the scattering quantification. A moderate correlation between scattering coefficients and RBC counts (R=0.5739) was observed, with a standard error (SE) of 1.30×10^{12} and MAPE of 21.48%, suggesting that scattering data can reflect RBC levels despite notable variance. Hgb, which is closely linked to RBC, showed a similar correlation (R=0.5623), with a MAPE of 22.66% and SE of 32.51 g/dL, indicating potential for qualitative Hgb assessment. WBC correlations were weaker (R=0.4270) but demonstrated potential within the official recommended range. **Conclusions:** These findings confirm that scattering coefficients contain valuable information about blood cell counts, supporting the viability of Vis-NIR spectroscopy for non-invasive hemogram diagnostics. However, variability in the data highlights the need for self-learning artificial intelligence (SLAI) correction models to enhance accuracy, particularly for less abundant components like WBC. This approach holds promise for transforming POC testing into clinical and field settings.

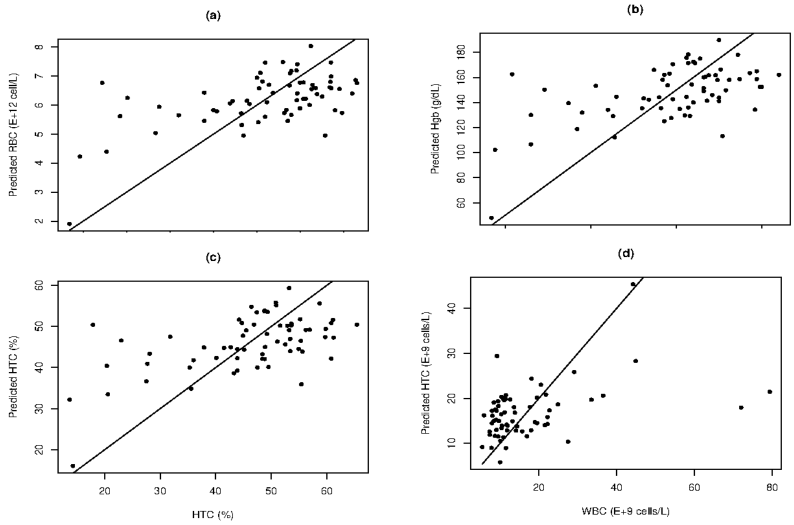

Figure 1. Correlation plots using scattering information for the quantification of: (a) RBC; (b) Hgb; (c) HTC; and (d) WBC.

Parameter	RBC (10^{12} cells/L)	Hgb (g/dL)	HTC (%)	WBC (10^9 cells/L)
SE	1.309	32.51	9.5	12.19
R2	0.3293	0.3161	0.3229	0.1823
MAPE (%)	21.48	22.66	21.99	49.87
R	0.5739	0.5623	0.5682	0.4270

Table 1. Benchmark results for scattering quantification of RBC, Hgb, HTC and WBC in dog blood.

Keywords: point-of-care; spectroscopy; hemogram; diagnosis; painless; reagentless; animal welfare; artificial intelligence

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References

1. Barroso, T.G.; Ribeiro, L.; Gregório, H.; Santos, F.; Martins, R.C. Point-of-care Vis-SWNIR spectroscopy towards reagent-less hemogram analysis. *Sens Actuators B Chem.* **2021**, *343*, 130138, doi: 10.1016/j.snb.2021.130138
2. Barroso, T.G.; Ribeiro, L.; Gregório, H.; Santos, F.; Martins, R.C. Feasibility of Total White Blood Cells Counts by Visible-Near Infrared Spectroscopy. *Chem. Proc.* **2021**; *5(1)*, 77, doi: 10.3390/CSAC2021-10434
3. Barroso, T.G.; Ribeiro, L.; Gregório, H.; Monteiro-Silva, F.; Neves dos Santos, F.; Martins, R.C. Point-of-Care Using Vis-NIR Spectroscopy for White Blood Cell Count Analysis. *Chemosensors* **2022**, *10*, 460, doi: 10.3390/chemosensors10110460
4. Barroso, T.G.; Queiros, C.; Monteiro-Silva, F.; Santos, F.; Gregorio, A.H.; Martins, R.C. Reagentless Vis-NIR Spectroscopy Point-of-Care for Feline Total White Blood Cell Counts. *Biosens.* **2024**, *14*, 53, doi: 10.3390/bios14010053