Portable NIRS spectrometer for field diagnosis of anemia in sheep infected with Haemonchus contortus

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Haemonchus contortus is a hematophagous parasite that causes anemia in sheep, triggering changes in hemoglobin levels detectable by near-infrared spectroscopy (NIRS). This technique is considered sensitive and fast, does not require sample preparation, consumption of reagents and does not generate residues. The objective was to evaluate the field performance of the portable NIRS spectrometer in the prediction of the packed cell volume (PCV) and also as a diagnostic tool for H. contortus infection.

NIR spectra (1350 - 2500 nm) were collected from 344 blood samples of White Dorper, Santa Inês and Texel sheep, in the field and laboratory, using NIRS portable Buchi (ProxiScout). These spectral data were properly concatenated to the respective reference results (PCV by hematocrit and classification between healthy and anemic animals based on PCV plus parasites' egg count per gram of feces - EPG), and used to generate and validate the multivariate models (quantitative modeling (PLS) and classification (PLS-DA).

The results indicated that the spectral acquisition environment (field or laboratory) did not have a substantial impact on the predictive quality of the models. Both models showed good performance for the diagnosis of anemia in sheep: PLS presented greater accuracy (91%) and sensitivity (100%), ensuring that none anemic animal was not identified (absence of false negatives); while PLS-DA was more specific (99%) and accurate (95%), with minimal false positive rate (1%), reducing the chance of mistakenly classifying healthy animals as sick. Thus, the two models offer complementary performance profiles: PLS is more suitable as a screening tool, ensuring the detection of all cases of anemia, while PLS-DA may be preferable in higher prevalence scenarios, when we seek to maximize the reliability of the positive diagnosis. As both models generate results concomitantly in the system, vets have immediate access to both quantitative prediction of PCV (via PLS) and categorical diagnosis of clinical status (via PLS-DA). This complementarity extends the diagnostic reliability and offers greater flexibility to support fast and assertive decisions for sheep anthelmintic treatment under real field conditions.