95. Evaluation of infrared thermography as a diagnostic tool for the detection of foot lesions in dairy sheep

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Application: Early and accurate diagnosis of foot lesions in dairy sheep is important to tackle lameness and ensure welfare. Infrared thermography (IRT) is a non-invasive nature technology, currently utilized by practitioners for the diagnosis of systematic diseases.

Introduction: Ovine interdigital dermatitis (OID), footrot and white line disease (WLD) are the most observed foot-related lameness causes in intensive dairy sheep systems. The associated lesions are revealed during routine and/or exploratory foot-trimming. Hence, considering the non-invasive of infrared thermography, our objective was to assess its diagnostic accuracy for the detection of foot lesions in dairy sheep.

Materials and methods: One hundred multiparous randomly selected dairy ewes from each of 6 enrolled farms were used in the study (n = 600 ewes). Data were recorded during routine foot-trimming and included lactation number, body condition score (BCS), OID, footrot and WLD lesions. Thermographic images were captured by an infrared thermographic camera (FLIR 8) and processed with Flir Tools software to estimate ambient (AT) and the maximum interdigital skin temperature (MIST), at the foot level (n = 2400 feet). The difference between AT and the MIST (DAMT) for each foot was calculated. SPSS v23 was used for data analyses, that included i) descriptive statistics, ii) two sets of binary regression analyses with lactation number, BCS (covariate) and MIST (covariate) used as predictors of the outcome variables (occurrence of OID, footrot, and WLD); in the second set MIST was replaced by DAMT, and iii) receiver operating characteristic (ROC) analyses to compare the diagnostic performance of sound foot (0) and foot with lesions (1) and to calculate the optimal efficiency threshold, sensitivity (Se) and specificity (Sp) values when the predicted (by the models) probabilities were considered.

Results: Overall, prevalence of OID, footrot, and WLD at the foot level was 8.1% (195/2400), 2.2% (52/2400), and 13.6% (326/2400), respectively. Mean MIST and DAMT were 33.8 ± 0.08 and 14.5 ± 0.08 °C, respectively. Both MIST and DAMT were significant predictors of the occurrence of OID, footrot, and WLD lesions ($P < 0.001$). In the case of MIST, one-degree Celsius increase of IST was associated with 1.39, 1.21, and 1.05 times increased probability of OID, footrot, and WLD lesions occurrence, respectively. The respective values for DAMT were 1.25, 1.16, and 1.08. The most effective models for setting threshold values for diagnosis of foot lesions were the ones that included MIST as covariate. The area under the ROC curve was 0.754, 0.698, and 0.567 for OID, footrot, and WLD lesions, respectively ($P < 0.001$). Optimal efficiency threshold values for the prediction of OID, footrot, and WLD based on the first set prediction equation estimates were 0.0926 (Se: 71.3% and Sp: 68.9%), 0.0237 (Se: 71.2% and Sp: 61.8%), and 0.1318 (Se: 68.4% and Sp: 41.4%), respectively.

Conclusion: IRT is a promising method for the early detection of OID and footrot in dairy sheep. However, assessing additional sites on the foot may further improve diagnostic performance and value.

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