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INFRARED MODELS FOR THE PREDICTION OF COW COLOSTRUM IMMUNOGLOBULINS G CONCENTRATION: PHENOTYPIC VARIABILITY AND RELATIONSHIP WITH COLOSTRUM YIELD

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The concentration of immunoglobulins G (IgG) defines the narrow-sense quality of cows' colostrum. Administering colostrum with IgG < 50 g/L is not recommended for newborns due to the insufficient amount of antibodies and concrete risk of failure of passive transfer of immunity. In a former project, we investigated the predictive ability of FTIR for the prediction of IgG using 530 colostrum samples harvested within 6 h from parturition in 9 Holstein farms. To develop infrared prediction models radial immunodiffusion kits were used for IgG determination (gold method) and spectra were collected through FOSS machineries used for official milk analyses (FOSS A/S, Denmark). Regression-based approaches, from PLS up to machine learning algorithms, were used to train and test the models and prediction accuracies showing R^2 in external validation (R^2v) range from 0.70 to 0.85 and a root mean square error (RMSEv) around 13 g/L. With this background, the COLOXINF project was born in 2022 in collaboration with the Breeders Association of the Veneto Region (Italy). A total number of more than 4,000 samples were harvested in 95 farms following the previous protocol and the colostrum yield (CY, L) at first milking was recorded. IgG was predicted using the best performing model (R^2v = 0.84; RMSEv = 13.4 g/L) and, using exclusively purebred Holstein cows, we estimated IgG for each CY level (I: ≤3 L, II: 3-4 L, III: 4-6 L, and IV: ≥6.1 L). Prior to the statistical analyses, lactations were grouped (parity 1, 2, 3, 4, and ≥5), and samples with IgG deviating more than 3 SD from the mean and with CY outside the range 0.1-15.00 L were eliminated. The mixed model accounted for the random effect of the herd and fixed effect of parity, calving season (SEAS), CY level, and interactions of parity with both CY and SEAS. In a second analysis, we studied the variability of CY adjusting for parity, SEAS, and parity x SEAS interaction, with the herd as random. IgG and CY were normally distributed, averaged 102.16 g/L and 4.63 L, and were negatively correlated (-0.18). IgG was the lowest in primiparous (83.71±2.40 g/L) and the highest in parity 5 (117.15±2.75 g/L) and varied according to CY: 110.44±2.30, 104.95±2.48, 98.50±2.47, and 93.23±2.53 g/L for class I, II, III, and IV. Estimates suggested that there is dilution and that, regardless of the parity, low-producing cows (in class I) deliver colostrum with greater IgG, e.g., 17.21 g/L more compared to IV. The significant interaction between parity and CY demonstrated that the greatest IgG was provided by the less-yielding cows in parity 4 (123.30±3.32 g/L) and 5 (124.06±3.58 g/L): considering that at least 200 g of IgG must be provided to calves at the first meal, it derives that just 1.6 L of colostrum collected from these cows is sufficient to cover the requirements. As regards CY, the lowest and greatest yield were found in parity 1 (4.19±0.24 L) and 2 (5.42±0.26 L), with the latter being not significantly different from parity 3, 4, and 5.