Development of a field test to evaluate colostrum quality (IgG) in cattle

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Failure of transfer of immunity from dam's colostrum generates a negative effect on calves' health leading to increased morbidity and mortality (De Nise et al., 1989; Wittum and Perino, 1995). Immunoglobulins (IgG) content of colostrum is highly variable and cannot be predicted. Distinguishing good from poor quality colostrum allows to adapt the volume administered or to initiate ancillary procedures for a sufficient transfer of IgG. The aim of the study was to evaluate the performances of a field test for colostrum quality determination.

Colostrum was collected from healthy Belgium Blue cows at calving. A Californian Mastitis Test (CMT) was made to reject potential subclinical mastitis. Thereafter, 3 mL of colostrum were added to the COL-IgG-Test consisting of a glass tube (12 mL) containing disodium EDTA, a solution with 12.5 mg of glutaraldehyde and excipients. The tube is immediately returned 2 times to mix and then every 30 seconds until the colostrum has coagulated. The coagulation time is noted. The remaining colostrum was transferred to plastic containers and frozen until IgG assay by Radial Immuno Diffusion (RID). Comparisons of coagulation time and IgG concentration by RID (Gold-Standard) were made using contingency table. Sensitivity (Se), Specificity (Sp), negative/positive predictive value (NPV/PPV), Chi-square (X^2), Youden index (Y) and Kappa of Cohen concordance test (K) of the COL-IgG-Test were determined. Cut-off indicating good colostrum was $\geq$ 50 g/L (Quigley et al., 2013) and $\leq$ 4 minutes respectively for IgG (RID) and coagulation time.

A total of 91 primiparous and pluriparous cows from 13 farms were assayed. The IgG concentration and the coagulation time were 92 ± 32 g/L (mean ± SD) and 3.7 ± 2.5 minutes, respectively. Compared to RID, COL-IgG-Test had a Se of 100%, a Sp of 90%, a NPV of 100%, a PPV of 53%, a Y of 0.9, a K of 65% and a X^2 of 43 ($p<0.001$). The low PPV comes to the fact that only 10% of colostrums were judged low quality (< 50 g/L IgG). To artificially increase the number of samples, all colostrums were diluted 1:1 with fresh milk (from a healthy Holstein cow, 42 days in milk, with negative CMT) and homogenized. COL-IgG-Test was realized following the same procedure. An artificial population of 182 samples was so constituted with an IgG concentration of 69 ± 34 g/L and a coagulation time of 5 ± 3.4 minutes. Among this new artificial population, there were 32% of poor quality colostrums. The performances of the test revealed a Se of 93%, a Sp of 82%, a NPV of 96%, a PPV of 71%, a Y of 0.75, a K of 70% and a X^2 of 93 ($p<0.001$).

COL-IgG-Test principle is based on the aptitude of gamma-globulins to coagulate while in contact with glutaraldehyde (Sandholm, 1974). In this study, only 10% of cows presented poor quality colostrum, which is in accordance with a recent study (Quigley et al., 2013). The dilution increased the PPV but slightly decreased the global performances of the test; however, the concordance (K) with Gold-Standard was somewhat better. This test, used with

pure colostrum, presents anyway a good concordance with gold-standard and has adequate performances for a field test. COL-IgG-Test is one of the most accurate and user-friendly semi-quantitative field test for the determination of colostrum quality, beside measurement with BRIX refractometer (Quigley et al., 2013). However, trials must be continued with poor quality colostrums in order to further determine the performances of the test.

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