

Decay of passive antibodies in calves fed maternal colostrum or a colostrum replacer

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Introduction

The passive transfer of immunoglobulins to neonatal calves via maternal colostrum is a major determinant of the calf's health early in life. It is important that each calf receive 150-200g immunoglobulin G (IgG) within two hours of birth. However, maternal colostrum (MC) can be highly variable in its IgG content and specific antibody levels. Colostrum replacers (CR) can substitute for MC and may provide a more consistent dose of both IgG mass and specific antibodies. Since high levels of colostrum antibodies can interfere with the humoral immune response to vaccination, knowing the time that calves become seronegative could allow for strategic timing of vaccination to produce a more consistent protective humoral immune response. The first objective of this study was to compare the level and persistence (antibody decay curves) for specific antibodies in calves fed either MC or CR. A second objective was to investigate whether feeding a CR (vs MC) would result in a more consistent time to seronegativity, with less calf-to-calf variability. We hypothesized that both forms of colostrum would transfer similar mean levels of antibodies, but that CR would deliver a more consistent time to seronegativity for diseases of interest.

Materials and Methods

The study was conducted on a commercial dairy farm in Western Wisconsin. Newborn heifer calves were removed from the dam before nursing and randomly assigned to receive either 3.8 L of MC (n=32) or three packets of Calf's Choice Total Gold (SCCL) CR providing a dose of 180 g IgG. Colostrum samples were frozen for analysis of total IgG content. Colostrum was fed by esophageal tube within 2 hr of birth. Venous blood samples were collected at 0 and 24 hr to measure serum IgG concentrations. Blood samples were also collected every 2 wk, up to 24 wk of age for analysis of antibodies against BVDV types 1 and 2 (results available), and against BRSV, PI3, BHV-1, Rotavirus and Coronavirus (results pending), using ELISA. Descriptive statistics were used to plot

the mean and variation in titers and to plot the antibody decay curve over 24 wk for BVDI and BVDII. Linear regression was used to describe the effect of treatment group (MC vs CR) on serum IgG at 24 hr and on mean antibody units for BVDI and BVDII at each sampling point over the 24 wk study period.

Results

Mean (SE) serum IgG (g/L) was higher at 24 hr for calves fed MC (32.2 +/- 1.8) versus calves fed CR (16.7 +/- 1.8). The BVDI and BVDII antibody decay curves for both treatment groups peaked at 24 hr and then slowly declined to reach near-baseline levels by approximately 18-20 wk (CR) and 20-22 wk (MC), respectively. Expressed as a unit value relative to a positive control (equal to 100), mean (SE) serum antibodies directed against BVDI and BVDII at 24 hr of age were higher for calves fed MC (BVDI=95.2 +/- 6.4; BVDII=80.8 +/- 6.4) as compared to calves fed CR (BVDI=73.0 +/- 6.3; BVDII=57.0 +/- 6.5), and continued to be higher throughout the decay period until the two groups reached similar baseline levels around 20 wk (BVDI) and 22 wk (BVDII), respectively. There was more variation in antibody units for MC versus CR calves. For example, at 24 hr the SD (range) in antibody units to BVDI was 44.5 (40.5 to 284.6) and 32.2 (19.2 to 152.7) for MC and CR calves, respectively.

Significance

While the lab results for other pathogens are still pending, these preliminary results indicate that on this study farm, calves fed MC and CR differed in the total serum IgG and in levels of antibodies against BVDI and BVDII at 24 hr, thereby producing a decay curve with antibodies persisting at higher levels for a longer period of time for calves fed MC. There was more variation in antibody units for MC vs CR calves. These findings support the idea that it may be important to consider the level, persistence and variability of colostrum antibodies for a specific farm when selecting a strategic time (age) to vaccinate. This hypothesis requires further study.