

Colostrum, as an effective defense mechanism, needs both a shotgun and a sniper in its artillery

How colostrum quality and specific antibody levels against scour-causing pathogens fall short even within well vaccinated herds.

QUICK READ

- Newborn calf immunity hinges on colostrum that has a full artillery of protection. A high level of general antibody serves as a shot gun, while concentrated levels of specific antibodies serve as snipers targeting the first scour causing pathogens a newborn is exposed to.
- Vaccinating dry cows with ScourGuard[®], Guardian[®] or Scour Bos[®] is a traditional way to increase antibody levels in colostrum against scour-causing pathogens such as coronavirus, rotavirus and *E. coli*. No protection is transferred in utero. These vaccines require the dam to mount an immune response and then transfer those specific antibodies into colostrum consumed by the newborn.
- A high level of both general antibody mass and antibody specificity against early calthood diseases is an optimal defense mechanism for newborns.
- In 97 single-cow colostrum samples from 10 well-vaccinated herds across the U.S., there was tremendous variability suggesting nearly half of the calves would have to rely on colostrum that was low in both general mass of antibody (<50g/l) and antibodies specific to scour-causing pathogens (assuming each calf would receive its dam's colostrum). No first-calf heifers were sampled.
- The variability was disproportionately weighted on the negative side as only 1%, 3% and 7% of cows provided colostrum that was both high in general antibody and titers against coronavirus, rotavirus and *E. coli* pathogens, respectively. This suggests dam-level scour vaccines don't assure protection to every calf, and pooling to compensate for variability may not be sufficient.
- It can be difficult to influence the mass of antibody a cow transfers into colostrum, but adding more snipers to the immunity army is much easier with the First Defense[®] line of USDA-approved veterinary products. These products ensure every calf receives a guaranteed level of specific coronavirus, rotavirus and *E. coli* antibodies to fend off the first bad guys coming through the door.

A Well-Equipped Army

Little improvement has been made toward reducing the impact of scours on dairy and beef operations over the years¹. Operations that have been able to reduce scour-related deaths, often find themselves nursing poor-doing calves back from the dead. This translates into high treatment costs and a drain on labor resources. Not to mention this usually results in "problem" cows entering the herd - those cows likely to be culled early before they provide a high return on investment. Scours is certainly one of the most frustrating and economically burdening animal health issues for our industry.

Colostrum quality is essential for appropriate immune development and successful passive transfer in calves which can minimize susceptibility to scours². Quality colostrum has been defined as clean colostrum containing a minimum of 50 g/l immunoglobulins, also known as general antibodies. Calves should consume 100-150g of immunoglobulin as soon as possible after birth.

Mass of general antibody is only half of the equation. To consistently prevent scours, you need both a general mass of antibody, which serves as a shot gun, and a high concentration of specific antibodies serving as snipers. Specific antibodies zero in on certain pathogens. They bind and neutralize scour-causing pathogens such as coronavirus, rotavirus and *E. coli*; the first bad guys through the door challenging newborn calf health. These pathogens not only cause infection but can also set the calf up to be more susceptible to other opportunistic diseases. The shot-gun and sniper combination provides successful passive immunity with a greater defense mechanism against specific scour pathogens.

Vaccinating cows during the dry-period to increase colostrum's level of antibodies able to target scour-causing pathogens is a traditional and commonly used tool to help manage early calf-hood scours. However, results within on-farm production settings have been mixed³.

This could be due to⁴:

- Layering of vaccines - Multiple vaccines given around the same time period can reduce the cow's ability to mount a sufficient response to any one vaccine.
- Environmental stressors - Often vaccines are given at the same time as a pen or ration change or during stressful chute work. These stressors can suppress the cow's vaccine response.
- Protocol drift - Small deviations from label requirements (primary vaccination - 2 injections, followed by an annual booster given within the required timeframe pre-calving) can result in a substantial reduction in specific antibody generation.

Study Design

To understand the level of shot gun and sniper defenses present in colostrum from a typical production setting, colostrum samples were taken from 10 herds across the U.S. (2 farms each from CA, ID, MI/OH, NY/PA, TX). These herds were using a dam-level scour vaccination program (57% ScourGuard® or 41% Guardian®) according to label directions for 3+ years. Colostrum was sampled from 97 individual cows (8-10 cows per farm) during the first colostrum milking post-calving. No colostrum was collected from first-calf heifers. General antibody mass (shot gun) was measured using Bethyl Laboratories assay and specific antibody titers (sniper) against coronavirus and rotavirus were quantified using virus neutralization assays. Specific *E. coli* antibody levels were determined by a USDA-approved titer assay. All lab work was conducted by RTI, LLC (Brookings, SD).

Plot graphs (**FIG. 1**) shows each cow's colostrum relative to mass of antibody and titer level against coronavirus, rotavirus and *E. coli*. Red lines distinguish the quadrants;

High : Low = High mass of antibody, low antibody specificity

Low : Low = Low mass of antibody, low antibody specificity

High : High = High mass of antibody, high antibody specificity

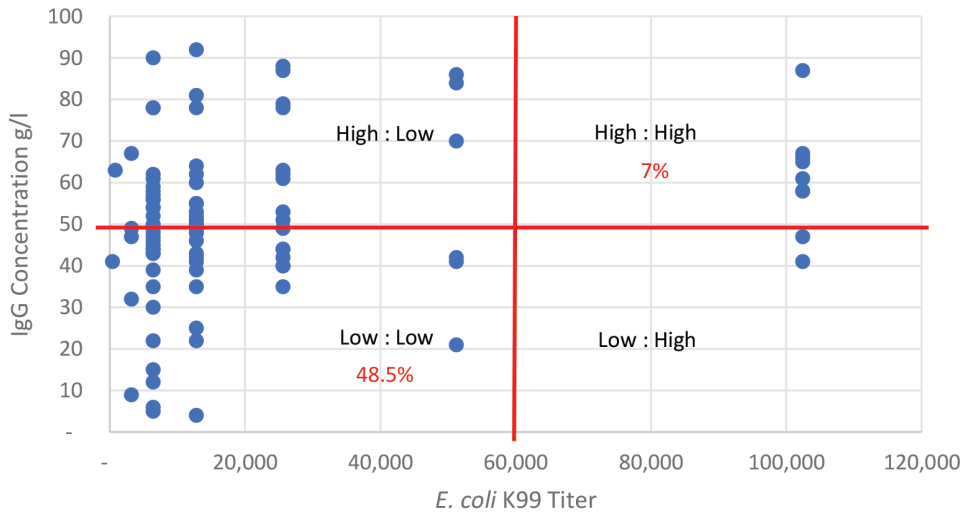
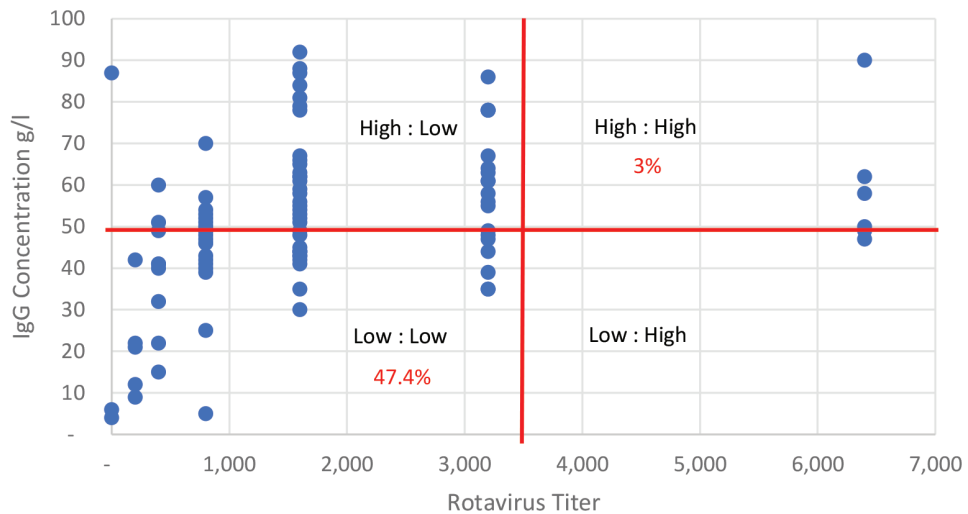
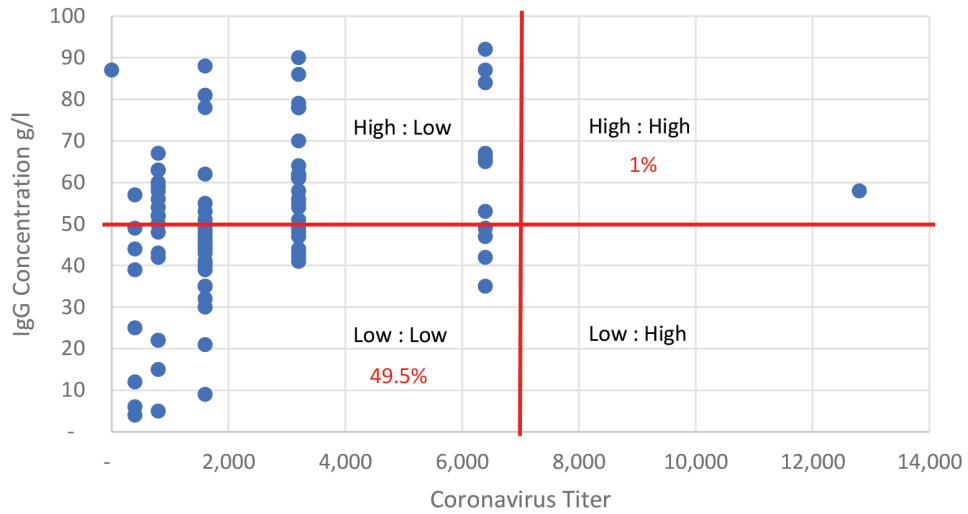
Low : High = Low mass of antibody, high antibody specificity

FIG 1 Colostrum quality and specific antibody levels against scour-causing pathogens.

97 samples from L2+ cows in well-vaccinated herds across the US.

High : Low = High mass of antibody, low antibody specificity
Low : Low = Low mass of antibody, low antibody specificity

High : High = High mass of antibody, high antibody specificity
Low : High = Low mass of antibody, high antibody specificity



Results

Nearly half of the cows sampled (47.4%-49.5%) provided colostrum which fell in the “low : low” quadrant - meaning colostrum was low in general mass of antibody and specificity against coronavirus, rotavirus and *E. coli* pathogens. Surprisingly, a minimal number of cows provided colostrum in the “high : high” quadrant; only 1% for coronavirus, 3% for rotavirus and 7% for *E. coli* . This indicates that a disproportionately small number of cows are providing colostrum with dual protection -general mass of antibody (shotgun) and specific antibody titers (snippers) against scour-causing pathogens. Pooling colostrum is often done to balance this cow to cow variation, but since so few cows fall in the high : high quadrant and so many fall in the low : low quadrant, it’s reasonable to expect this variability cannot be successfully overcome with pooling.

Conclusion

Increasing general mass of antibody is difficult but attention to dry-cow feed intakes and immediate milking after calving can help. However, ensuring each calf receives a guaranteed level of antibodies specific to scour pathogens such as coronavirus, rotavirus and *E. coli* is easier with the First Defense® line of USDA-approved veterinary biologics. These antibody products require titer level verification prior to the sale of each batch produced. This ensures consistency. Each calf can indeed receive a concentrated level of specific antibody approved by the USDA Center for Veterinary Biologics to reduce scour mortality and morbidity associated with coronavirus, rotavirus and *E. coli* , providing a full artillery of defenses to protect your genetic investment.

SOURCES

ScourGuard® is a registered trademark and the property of Zoetis Services LLC
Guardian® is a registered trademark of and property of Intervet Inc., doing business as Merck Animal Health, a subsidiary of Merck & Co., Inc.
Scour Bos® is a trademark of Eli Lilly and Company or its affiliates.

1. USDA. Dairy Heifer Raiser. USDA-APHIS-NAHMS; 2011.
 - a. USDA. Dairy 2014: Health and Management Practices on U.S. Dairy Operations. USDA-APHIS-NAHMS; 2014
 - b. USDA. Beef 2007-2008 Part IV: Reference of Beef Cow-calf Management Practices in the United States. USDA-APHIS-NAHMS; 2007-08.
2. Weaver, Dusty. Passive Transfer of Colostral Immunoglobulins in Calves. Journal of Veterinary Internal Medicine. Vol 14. Issue 6 (2008): 569-577.
3. Waltner-Toews, D. A. Field Trial to Evaluate the Efficacy of a Combined Rotavirus/Coronavirus-Escherichia coli Vaccine in Dairy Cattle. Canadian Journal of Comparative Medicine. 49. 1 (1985): 1-9.
4. Wenzel, John. Cattle Vaccination and Immunity. New Mexico State University Cooperative Extension. Guide B-222 (2015) 1-2.