

Preventing and Reducing the Impact of Neonatal Diarrhea in Calves

Calf diarrhea, also known as calf scour, is one of the major causes of neonatal calf mortality, which has been estimated to cost farmers around 60 to 80 Euros per calf,¹ with up to three in four calves affected.² Calf scour can result in a decrease in performance in the short-term, and in the longer-term impact future production. It also has significant welfare impacts through the pain of the disease, combined with the risk of mortality, as well as increasing the use of antimicrobials.

Causes of Calf Diarrhea

Neonatal diarrhea is most commonly caused by infectious agents or nutritional disturbances. The main infectious agents are Enterotoxigenic *E. coli* (F5 adhesin) or ETEC, bovine rotavirus, bovine coronavirus, cryptosporidiosis, Salmonella, coccidiosis and other minor pathogens. It is important to note that the outbreaks often include multiple pathogens. For practitioners, it is worth considering the impact of determining the pathogen(s) involved in the outbreak in terms of changes to treatment and prevention protocols, as well as public health-related issues (e.g. zoonosis potential, identification of a reportable/notifiable disease).

Treatment of Calf Diarrhea

One of the key components of a treatment plan for calf scour is rehydration, as mortalities caused by infectious pathogens are a result of the lack of fluid replacement. The estimation of the volume of fluid required in a calf is based on clinical signs, which estimate the proportion of fluid lost by the calf, for example a loss of 5% bodyweight for a 40 kg calf is 2 liters. Replacement of fluids can be delivered orally or by intravenous fluid therapy, depending on the severity of the clinical signs. Additionally, the use of non-steroidal anti-inflammatories (NSAIDs) is important for reducing the intestinal damage, caused by the response of the immune system to the presence of an antigen. As part of

the treatment, a single injection of meloxicam (Metacam®) was reported to improve all relevant clinical symptoms of diarrhea including fever, allowing a faster recovery. It was also shown to increase feed consumption, either milk or solid feed, and decrease discomfort that is associated with sickness behavior.³ Another important aspect is the isolation of sick calves, either as individuals or as a group. Biosecurity measures like the disinfection of tools, equipment and boots will also aid in reducing the transmission on the farm.

Ensuring the correct treatment protocol is in place is important for improving the success of treatment and reducing the degree of short and long-term production effects and overall mortality and morbidity.

Prevention is Key

The main enteric pathogens are found in adult bovine feces, which act as a reservoir of infection. Therefore, one of the key strategies to prevent the spread of calf diarrhea is hygiene through the reduction of exposure of calves to enteric pathogens in either the calving area or calf rearing area. Calves need to be removed from the source of infection and other calves that are shedding the pathogen because of current infection.

Another crucial measure for the prevention of calf scour on farm is excellent colostrum management to ensure the transfer of passive immunity from the dam to the calf. Colostrum, the first milk from the dam, is hugely important for neonatal calves, as they do not receive any maternal antibodies in utero from the dam and are entirely dependent on the innate immune system and passive transfer from maternal antibodies. Colostral immunoglobulins are pivotal for bridging the gap between specific local pathogenic antigens and the innate immune activities of the calf. A failure to receive sufficient colostrum antibodies has been reported to increase the chance of mortality and diarrhea by 2.16 and 1.51 times respectively.⁴

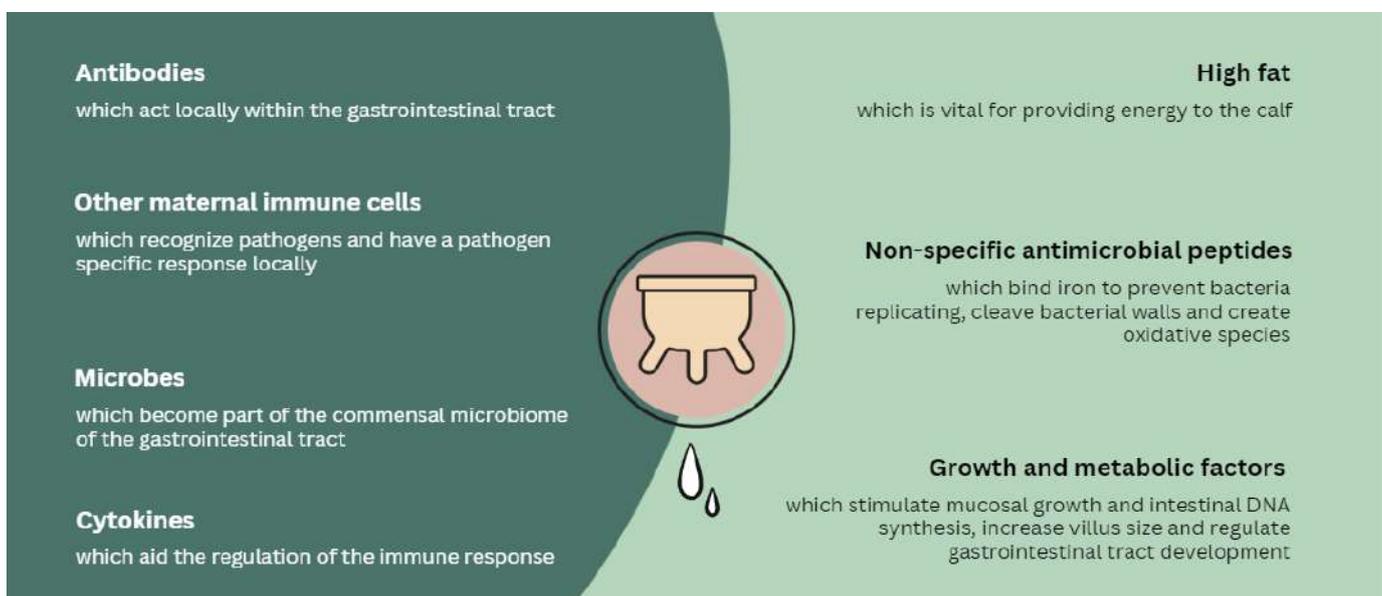


Figure 1. An overview of the components of bovine colostrum.

The general rules of thumb for optimum colostrum management are as follows:

- **Volume:** recommendations for volume of colostrum fed are 10–15% bodyweight in the first feed to ensure that the critical amount of immunoglobulin is consumed.
- **Quality:** the quality of the colostrum ensures that there is an adequate concentration of immunoglobulin in the colostrum fed.
- **Timing:** the recommendation is that calves receive colostrum within the first 2 to 6 hours of their life as there is an increase in intestinal wall permeability at birth to facilitate the absorption of immunoglobulin which decreases over time and has disappeared by 24 to 36 hours of life.
- **Cleanliness:** colostrum quality is impacted by cleanliness, as the immunoglobulin in the colostrum will bind any pathogens that are present in the colostrum, thus making them unavailable for absorption into the bloodstream.

One method of boosting colostrum antibodies to fecal pathogens is through vaccination of the dam during the dry period to promote the production of antibodies against rotavirus, *E. coli* and coronavirus. Vaccination of the dam is required as the vaccines have limited use in calves during the risk period (< 3 weeks of age) because of their immature immune system and the interference of maternally derived antibodies (MDA).⁵

Successful vaccination and excellent colostrum management are inseparably connected: The vaccination of the dam relies on delivery of around 10% of birthweight by volume of clean, high-quality colostrum within 2 to 6 hours of birth, as it will otherwise not have any impact.

Holistic Approach: Vaccination and Lean Calf Management

Boehringer Ingelheim has just launched the first vaccine licensed for prevention of calf scour. It prevents diarrhea caused by rotavirus and *E. coli* F5 (K99) adhesin and reduces the incidence and severity of diarrhea caused by coronavirus. Viral shedding in calves infected by rotavirus and coronavirus was also reduced. This level of protection is unique among calf scour vaccines. Launched following extensive and recent registration studies, it is the only single-shot annual vaccine in the market that harnesses an oil-free adjuvant to boost the immune response to the three pathogens.

The level of protection was demonstrated through a series of laboratory studies with 40 cows vaccinated, and 20 cows as controls. Calves were challenged 12 hours after birth in the *E. coli* study and seven days after birth in the coronavirus and rotavirus studies to investigate onset of immunity, and after 14 days in the coronavirus study to assess duration. Calves were fed colostrum and transition milk from vaccinated or control dams in a supervised manner for seven days in all studies after birth, followed by experimental challenge.

Comprehensive monitoring of both the dams and calves was undertaken, including blood samples collected from calves on the day of birth, on the day of challenge and at the end of the study to assess the degree of passive immunisation received. Fecal samples were taken daily for seven days from the day of challenge in the viral challenge studies, to determine the amount of virus excreted.

The studies demonstrated unrivalled protection against calf scour in calves from vaccinated dams, achieving the unique claim of prevention against calf scour caused by bovine rotavirus and *E. coli* F5. A visual representation of the laboratory efficacy studies performed can be seen in figure 2.

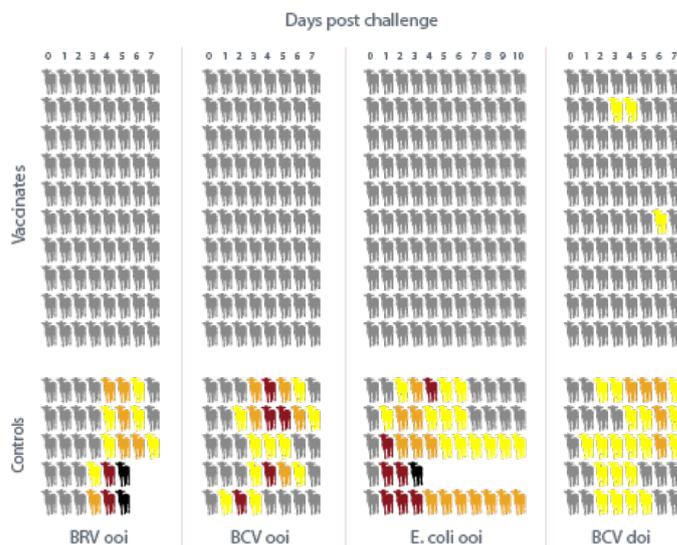


Figure 2. Visualisation of the outcome of the laboratory studies

The colors of each calf represent the outcome of the challenge with regards to calf scour. Normal, healthy feces and calves are represented by the grey calves. Yellow calves represent animals with signs of mild diarrhea. Orange calves represent the ones with moderate diarrhea and red calves represent cases with severe clinical signs. The black calves represent the animals that died as a result of diarrhea.

The graphic visually demonstrates the impact of protection by vaccination: Calves from vaccinated dams showed no scour following challenge for either the rotavirus or *E. coli* study. Whereas the control group showed six severe cases of diarrhea and three calves dying from it. For the seven day coronavirus challenge, there was also no scour in the calves from vaccinated dams, with only two calves showing mild symptoms of diarrhea in the 14 day challenge.

Further tests have shown significant increases in antibody levels in dams' serum, colostrum, and calves' serum, as well as reduced viral shedding.

To realise the full potential of the benefits of colostrum and the vaccine antibodies it contains, quality and quantity of colostrum and timing are crucial. This is where the lean process management approach comes in and has proven to be extremely valuable.

The history of lean management goes back to Japan in the 1980s and 1990s when a big automotive company outperformed its competitors by focusing on efficiency increase. The key to this success was "less of everything" and the lean management describes exactly that.

Boehringer Ingelheim provides a holistic lean approach to cattle farming through its training and support services. This is aimed at veterinarians to allow them to further improve calf management and ensure optimal gut and immune health, inspiring excellence in calf rearing.

Gerald Behrens, Global Head of Ruminants at Boehringer Ingelheim, says: "We are excited to have launched the first



vaccine in the market that prevents calf scour. Together with our lean management trainings for vets, it supports excellence in calf management, particularly around the vital feeding of colostrum to calves.”

As farming has changed towards increasing productivity, so has the role of the farmers shifted from craftspeople, working one on one with their animals and people, to managers and leaders. The use of lean management helps them optimise processes and hence achieve greater efficiency, increased consistency, reduced costs, and bigger production.

“Boehringer Ingelheim will provide guidance to veterinarians for the use of lean management tools to maximise the impact of our vaccine on farm and help farmers produce healthier and more productive calves”, Behrens concludes.

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