By HANNE SKOVSGAARD PEDERSEN, DVM, PhD and Calf Specialist for coloQuick International

Antibodies in colostrum translates into higher producing, longer lasting dairy cows

For a heifer calf, colostrum is one of the most decisive factors for future milk yield. Improving colostrum management is simple and does not require large investment of money - but remember, with every calf you only have one chance to do it right.

Four key areas to focus on when optimizing colostrum management:

1. How improving colostrum management can increase the **profitability of your farm**
2. Why measuring **colostrum quality** is crucial
3. Why the **time to first feeding** of colostrum is critical
4. Why the importance of **good hygiene** while collecting and feeding colostrum cannot be understated

This is the second of four articles focusing on why measuring colostrum quality is crucial.

About Hanne Skovsgaard and coloQuick International

Dr. Hanne Skovsgaard Pedersen, DVM, PhD is a calf specialist with experience as large animal veterinarian and researcher. She focuses on staying current with scientific publications and developing literature that explains the biology of the calf. She is passionate about the dissemination of knowledge and optimizing calf management on farms around the world.

coloQuick International is a division of the Danish company, Calvex A/S (est. 1992). At coloQuick we supply products and expert level advice, to increase farm profitability and reduce the use of antibiotics in dairy herds by focusing on the first hours of a calf's life.

In humans, a pregnant mother is able to pass antibodies to her unborn baby through the placenta. This is not the case for the cow and other ruminant species. The structure of their placenta is different, which prevent the transfer of large molecules to the calf inside the uterus (Brambell 1958). That is why it is absolutely crucial, to the calf to consume high quality colostrum immediately after birth. Colostrum provides the calf with passive immunity within the first few hours of the calf's life. A poor supply of colostrum leaves the calf vulnerable to disease in the first weeks (Figure 1), and it has been shown that calves that experience disease early in life will produce less milk as cows (Heinrichs & Heinrichs 2011).

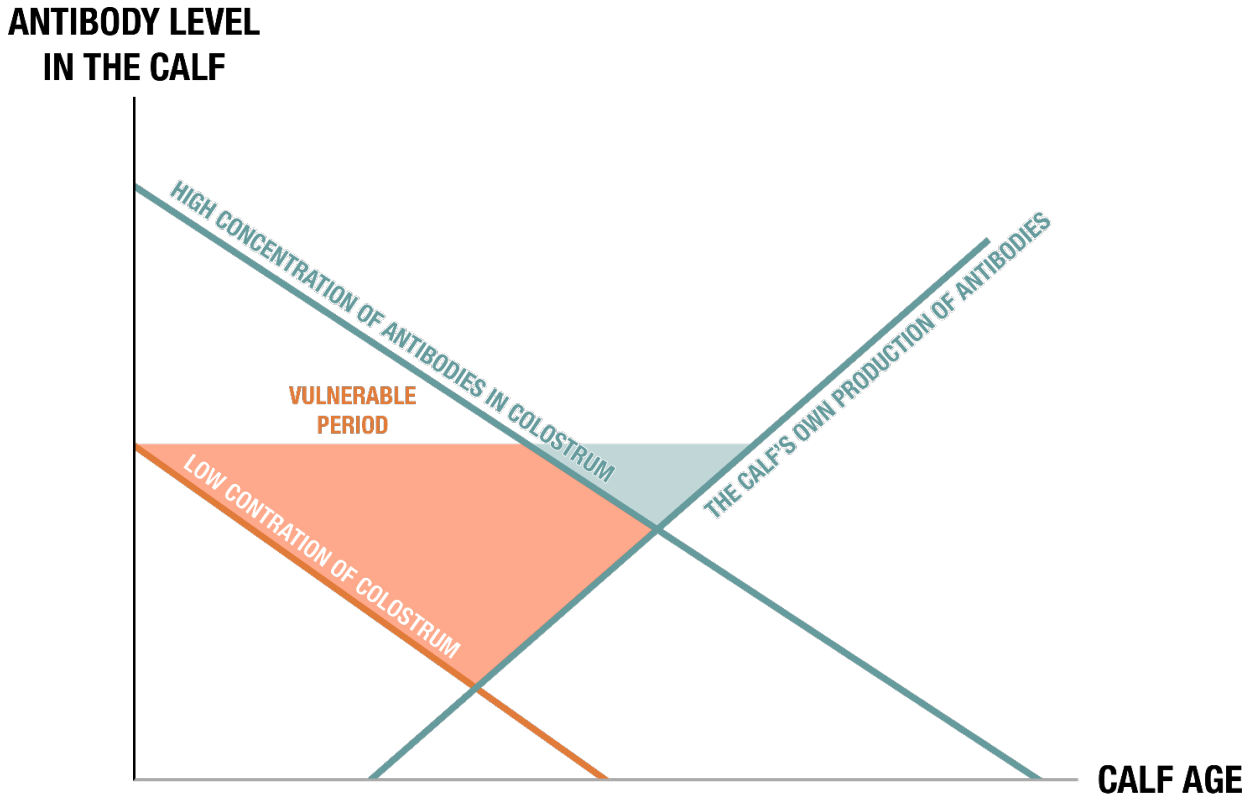

Figure 1: *A good supply of colostrum ensures excellent health and growth until the calf's own production of antibodies is established. In contrast, a poor supply of colostrum increases the risk of infection, reduces the calf's growth in the first weeks of its life and decrease its later milk production.*

Research reports a huge variation in colostrum antibody concentration

Having a system in place and communicating a clear strategy for colostrum feeding, helps calves become strong cows with a high milk yield. One of the main challenges for all colostrum management programs is the significant variation in the antibody concentration of colostrum between the cows in a herd (Table 1). The variation in colostrum quality between cows is due to several factors, including, but not limited to: feeding and management of the dry period, genetics, parity and the time interval from calving to milking.

Table 1: *Published research showing large variations in the antibody (IgG) concentration in colostrum*

References:	No. of colostrum samples	Antibody concentration in colostrum samples (Min. - Max., IgG g/L)	Average antibody concentration (IgG g/L)
Løkke et al., 2016	126	3 - 154	60
Baumrucker et al., 2010	214	9 - 166	38
Gulliksen et al., 2008	1250	4 - 235	45
Kehoe et al., 2007	55	11 - 70	35
Swan et al., 2007	457	9 - 186	76
Quigley et al., 1994	88	30 - 121	70
Pritchett et al., 1991	919	20 - 111	48

Please note: In the referred studies, the concentration of IgG in colostrum was estimated using radial immunodiffusion. These values are not direct comparable with the BRIX value, we tend to measure on farm

As shown in the table, the antibody content in colostrum varies widely. It is impossible to predict in advance, to what extent a cow, or a heifer, will produce colostrum of a high or low quality. If the calf nurse colostrum directly from the dam, or if colostrum quality is not measured quantitatively by an objective tool, the calf's future will be random and completely left to chance. On the other hand, if there is a system in place and all colostrum is tested before it's fed, each calf in the herd is given the best opportunity to develop into a strong cow that produce more milk and stay in the herd for years to come.

It is not possible to predict colostrum quality

Colostrum quality varies in every herd, so it's important to test colostrum at every collection, from every animal. The antibody content of colostrum cannot be predicted — even parity is not a reliable predictor of colostrum quality. Statistically speaking, there is a greater chance that older cows produce higher quality colostrum, but in reality, heifers can produce high quality colostrum too. This means that number of lactations is not suitable as an independent criterion. Similarly, antibody content cannot be accurately predicted using factors like the consistency or colour of the colostrum.

How to evaluate colostrum quality on farm

We recommend evaluating colostrum quality using a BRIX refractometer. Either an optical BRIX refractometer (shown in Figure 2), which costs less than EUR 30, or a digital refractometer, which costs between EUR 150-450 can be used. A refractometer measures how the light bends, or refracts, as it passes through a given liquid. This measurement can be used to directly predict the solids concentration of liquids like milk and colostrum. Researchers has shown the % BRIX is also a good prediction of the antibody concentration of colostrum (Bielmann et al. 2010, Bartier et al. 2015). A Brix refractometer is a fast and easy way to evaluate colostrum quality on farm.

When using an optical BRIX refractometer, you will record the % BRIX by reading the value yourself. An example of the scale is shown in Figure 2. To take a measurement, simply place a few drops of colostrum on the refractometer, close the cover, and point the refractometer at a light source. In Figure 2, the % BRIX should be recorded at 24 as this is the lowest value the blue field touches. It is important to clean the refractometer after use, and regularly recalibrate using distilled water. An optical BRIX refractometer will provide accurate readings, when used properly, and is a low investment to make, when you want your team to start testing colostrum.

Figure 2: *We recommend testing colostrum quality using a BRIX refractometer, to ensure that all calves receive high quality colostrum.*

Determining your herd specific cut point

The threshold of 22 % BRIX (corresponding to an IgG content of at least 50 g/L) in the colostrum is often cited in published research and popular press articles. Instead, we believe the goal of any colostrum program, should always be to feed the highest quality colostrum available in the herd, every time a calf is born.

Once you start using a BRIX refractometer, you will see the variation in colostrum quality discussed earlier. From this information about colostrum quality in your herd, we recommend, to establish a herd specific cut point, being the guideline for what colostrum to keep and feed to the calves in your herd (Figure 3). At the same time, efforts should be made to improve colostrum quality and increase the herd specific cut point according to the level of colostrum quality (Figure 3, herd B).

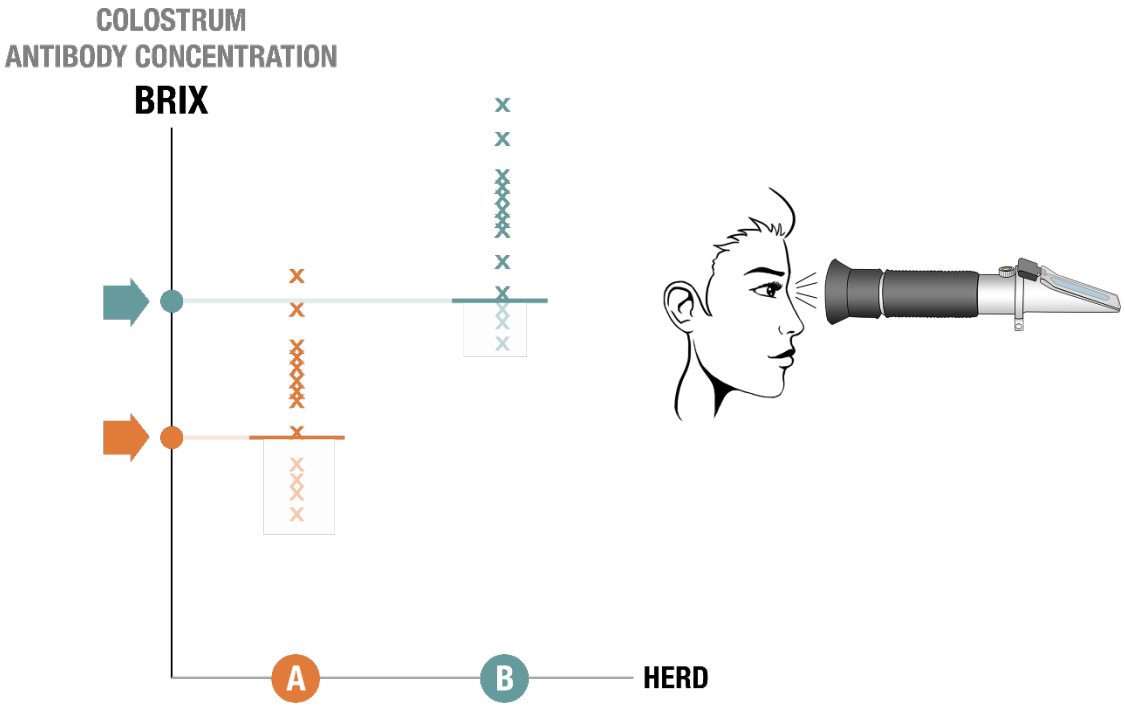

Figure 3: Illustration of the practical approach for optimizing colostrum management in two herds (A, B) with different colostrum quality. Herd A produces colostrum with a lower BRIX score compared to herd B. A herd specific cut point should be set for each herd (Herd A); Herd B), to ensure that all calves receive only the best colostrum produced by the herd.

It's better to always choose your highest and best

Like with most things, we should always be striving for our highest and best. When discussing colostrum quality, it is important to remember that the traditional threshold of 22 % BRIX is based

on studies from the 1980s and 90s, conducted on farms with different conditions and lower targets for milk production, compared to many modern dairies. The results of these studies showed a reduced frequency of disease and mortality among calves with a serum IgG ≥10 g/L (Gay 1983, NAHMS 1993). However, we believe that it is beneficial to the calf's health, growth and subsequent milk production to strive higher. Newer studies also show an effect from raising the bar and aiming for a higher antibody absorption to the calf's blood (Urie et al., 2018, Lombard et al. 2020).

A simple, but incredibly effective step

Measuring colostrum quality and feeding only the herd's best colostrum is a strategy that will work for all herds. Measuring colostrum quality is a simple and easy step towards optimizing colostrum management on your farm, improving calf health- and growth; resulting in healthy, high producing and long lasting dairy cows.

The three most important things to remember:

1. The calves need to consume high quality colostrum to stay healthy and grow up to become high producing and long lasting dairy cows.
2. Due to the huge variation in colostrum quality from one cow to another, it important to measure colostrum quality at every collection, for every animal.
3. Define a herd specific cut point and always feed the highest quality available for the calf's first feeding.

The increased focus on BRIX measurement and sorting of colostrum has resulted in improved health and growth among the calves in the herd.

Thawing of quality-tested colostrum from the colostrum bank in the coloQuick water bath, makes it easy to ensure an optimal start for all calves.

Strong calves by testing and sorting colostrum

Many antibodies in the colostrum result in good calves and strong, high producing cows. Vedsted Cotel screens the colostrum and uses the best for all calves, resulting in better health and growth.

Consistently measuring the antibody content in the colostrum with a BRIX refractometer and storing the best colostrum in the herd in a colostrum bank has led to stronger calves and increased growth at Vedsted Cotel.

That is how Emil Vestergaard and Kristina Lund explain progress in the calves in their herd. Together, they are responsible for the calves at Vedsted Cotel.

“We had serious problems with diarrhoea and mortality among the calves. We sharpened our focus on housing, cleaning and colostrum management, and we saw great improvements in health and well-being,” says Emil Vestergaard.

The workers in the stall were discouraged and frustrated about the situation.

“It was tough going to work, both because the calves were not thriving, and because we know that the heifer calves are the future of the herd. Fortunately, we had good advice from coloQuick International about optimizing colostrum management, and in that way, we became aware of the antibody concentration in the colostrum,” says Kristina Lund.

"Before the changes, we did not test and sort the colostrum for the calves, so we had no control of how many antibodies the calves were actually fed," says Emil Vestergaard.

"So, it was a matter of chance whether a new-born calf got off to an optimal start."

The majority of the calves were fed too few antibodies

Blood samples taken to test the calves' uptake of antibodies showed that six of the seven calves tested had very low antibody levels.

"We started to measure all colostrum with a BRIX refractometer and became aware of the great variation in colostrum quality among the cows. Some cows produced colostrum with a BRIX value of 13, while others were up to 25," says Kristina Lund.

On the farm, Kristina Lund and Emil Vestergaard can at present set their herd specific cut point to 20 % BRIX (see Figure 1) and still have a portion of colostrum for all new-born calves.

"In busy calving periods we may be forced to lower our cut point, but we will still carry out the quality assessment, and ensure that all calves always get the best colostrum in the herd," says Emil Vestergaard.

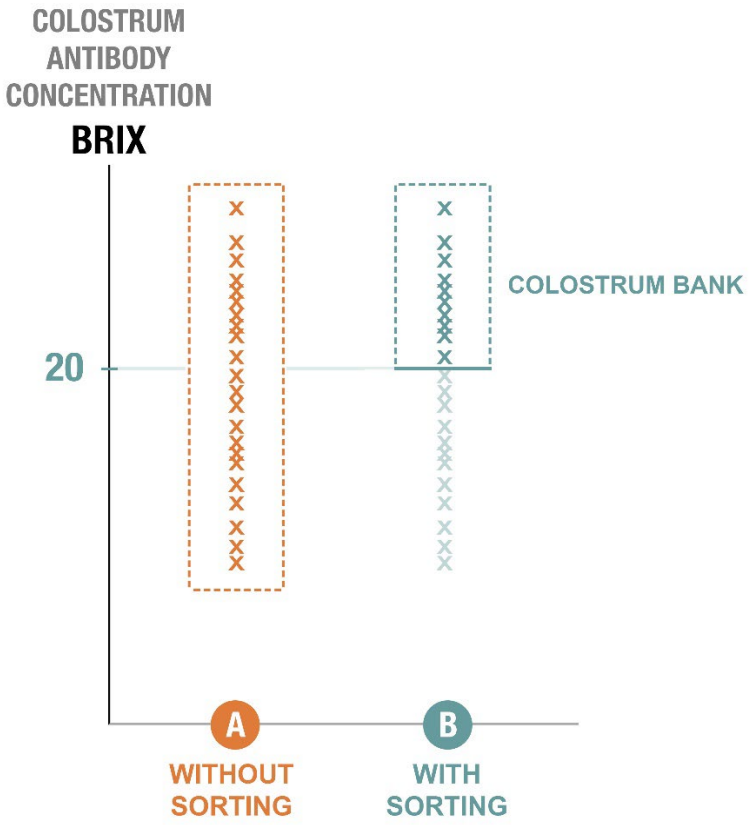

Figure 1

Two different scenarios for using the herd's colostrum. Before BRIX measurement and sorting of colostrum, all available colostrum was fed to the calves (A). After optimization of colostrum management including BRIX testing and sorting (B), the herd use only colostrum with a BRIX score above the herd's specific cut point (blue dotted line)

At the same time, great care is taken to give the calf colostrum as early as possible after birth, and to optimize the feeding of dry cows.

On the farm the coloQuick system is used to manage colostrum, which means that good colostrum management is easier in practice.

“We freeze the tested and sorted colostrum in 4-litre disposable bags, and warm up a portion of colostrum in the coloQuick water bath after each calving. A systematic work routine like that also frees up time and enables us to work efficiently in the stall,” says Emil Vestergaard.

There are fixed procedures for giving colostrum, and it means the general gut feeling is good, and job satisfaction is better.

Using a refractometer for testing the antibody concentration in colostrum, is easy to do and is used consistently in the herd, for testing and sorting of colostrum

The calves thrive outdoors

Apart from the changes around colostrum management for the herd, the housing for the calves was changed from indoors to calf sheds in the open air. At the same time, attention was concentrated on continuity and stability about looking after the calves, and now fewer individuals are involved. Emil and Kristina feel quite different about going to work now. The changes have resulted in considerably fewer cases of illness, very low mortality and larger calves.

“The calves thrive and come to the feeding bucket when they see us,” says Kristina.

Blood samples to show the calves’ uptake of antibodies, also showed recently, that all the calves tested now have a far better antibody uptake.

Screening the colostrum for quality means tangible improvements in the calf stall, motivated the workers looking after the calves to make an extra effort, and ensured confidence in production of strong heifer calves that can become high producing dairy cows in the future.

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