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THE COLOSTRUM COUNSEL

Improving The Quality Of Maternal Colostrum Through Supplementation With A Colostrum Replacer

Introduction

Colostrum, rich in nutrients and antibodies, is essential for providing passive immunity to newborn calves. The concentration of Immunoglobulin G (IgG) in colostrum is a key factor in determining its quality, and Brix refractometry is commonly used on farms as an indirect measure of IgG concentration in colostrum.

Feeding calves with high-quality colostrum during the first hours of life is crucial for ensuring adequate IgG transfer, as calves strictly rely on it to develop disease resistance (Figure 1). However, the quality of maternal colostrum can vary significantly among cows within the same herd. In this context, enriching maternal colostrum with a colostrum replacer has emerged as an effective strategy to improve quality by increasing levels of IgG, nutrients, and bioactive compounds.

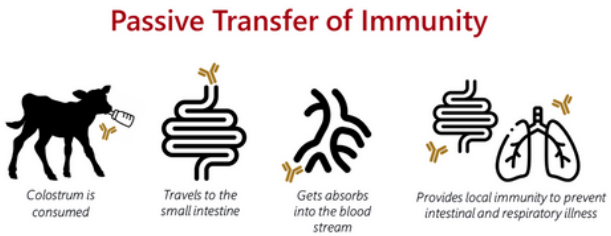

Figure 1. Graphical representation of the transfer of passive immunity mechanism in newborn calves.

Brix % and variability of maternal colostrum

For colostrum to be considered high quality, it must have an IgG concentration greater than 50 g/L (McGuirk and Collins, 2004). A practical, quick, and cost-effective way to measure colostrum quality on the farm is through the use of a refractometer (Bielmann et al., 2010). Instead of directly measuring IgG concentration, the refractometer assesses the total protein content of colostrum, providing results expressed in % Brix.

The correlation between % Brix and IgG concentration in colostrum is quite high, especially in the first hours after calving (Quigley et al., 2013). Research has shown that a Brix of 22% or higher generally indicates good quality colostrum, with an adequate amount of IgG to ensure passive transfer of immunity (Quigley et al., 2013) and guarantee optimal calf health. In this regard, if a person were to feed a 40 kg calf 4 liters of a 22% Brix colostrum, they would be providing 200 grams of IgG.

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This has been a general guideline for many years for a Holstein calf, which should receive 10% of its body weight (.1 X 40 = 4L) at 22% Brix (50 g IgG/L x 4 = 200 grams of IgG). However, new recommendations indicate that calf morbidity and the rate of failed passive transfer decrease when more antibodies (IgG) are provided in the colostrum. These new recommendations now suggest providing 300 grams of IgG to achieve excellent passive transfer. What does this mean in terms of Brix? It means that we need to raise the standards on the farm to select colostrum with Brix levels higher than 24%.

However, ensuring consistent colostrum quality in a herd is very difficult, as there are conditions that cause significant variability among cows in the same herd. This variability is influenced by factors such as age, breed, nutrition, prepartum vaccinations, milk production, and the interval between calving and colostrum collection, among others (Moore et al., 2005; Conneely et al., 2013). In a study conducted in 8 dairy farms in the United States (Figure 2), which analyzed IgG concentration in maternal colostrum through refractometry, Brix percentages ranged from 12% to 32%, with an average of 23.8%, indicating the vast variability in IgG concentration among cows (Quigley et al., 2013). This study by Quigley et al. (2013) highlights the challenge of relying exclusively on maternal colostrum to ensure adequate quality and, therefore, correct passive transfer of IgG in calves.

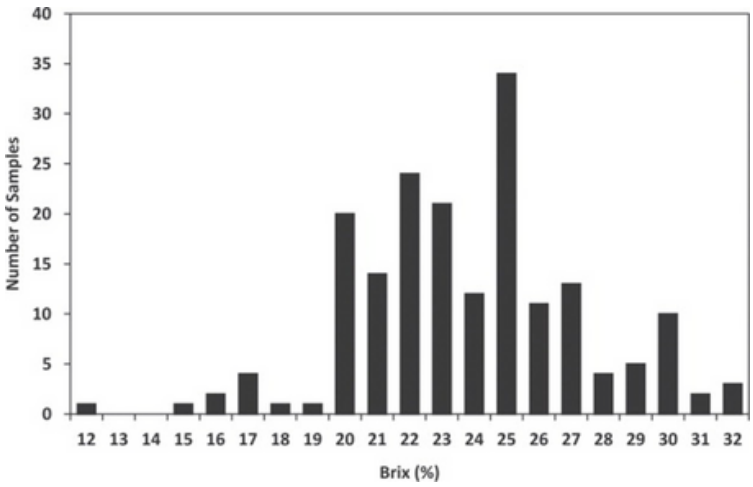

Figure 2. Adapted from Quigley et al. (2013). Distribution of total protein in maternal colostrum estimated through Brix refractometry

To address this variability and improve the quality of maternal colostrum, an effective strategy is the enrichment with a colostrum replacer. This strategy presents itself as a viable alternative to overcome the limitations associated with differences in the quality of maternal colostrum available on the farm, thus ensuring greater consistency in the transfer of essential antibodies for the immune development of the calves.

Benefits of enriching low-quality maternal colostrum

The enrichment process involves adding a precise amount of colostrum replacer directly to the maternal colostrum. This way, if the maternal colostrum has a low Brix percentage, for example between 15% and 24%, and we want to increase it to higher quality percentages, we can enrich it with a colostrum replacer that has a consistent IgG level.

When and why should we consider enriching maternal colostrum?

1. To increase the immunological quality of the maternal colostrum.
2. To decrease variability in colostrum quality within the herd.
3. In cases of delayed colostrum milking.
4. To provide broad protection against pathogens.
5. To improve thermoregulation in calves in extreme cold or hot climate conditions.
6. When calves:
    a. Are born to first-time heifers.
    b. Are born to cows with poor nutrition.
    c. Are small, with low birth weight.
7. In cases of dystocia (C-section) due to decreased apparent efficiency of IgG absorption (Murray et al., 2015).
8. In high genetic value calves.

There is scientific evidence supporting the usefulness of enriching maternal colostrum. In a study conducted in Canada, researchers investigated whether low-quality maternal colostrum could be enriched with bovine colostrum replacer to reach adequate serum IgG levels in newborn calves (Lopez et al., 2023).

In this study, the researchers fed the calves maternal colostrum with a Brix content of 15.8% (equivalent to 30 g/L of IgG), achieving an average serum IgG concentration of 11.76 g/L (Figure 3). This IgG concentration falls within the "fair" category on the most recent passive transfer of immunity classification scale (Lombard et al., 2020).

The maternal colostrum was then supplemented with 551 g of colostrum replacer (Saskatoon, SK, Canada; SCCL) to bring the IgG concentration up to 60 g/L. Calves that were fed the combination of maternal colostrum + colostrum replacer had an average serum IgG concentration of 19.85 g/L, thus moving from the "fair" to the "good" category on the passive transfer of immunity scale of Lombard et al. (2020).

Furthermore, 18.8% of the calves fed maternal colostrum with 15.8% Brix experienced failure in the transfer of passive immunity. However, when that colostrum was enriched with colostrum replacer, 0% of the calves showed failed passive immunity (Lopez et al., 2023). In another similar study conducted in Brazil, calves were fed maternal colostrum with 25% Brix or maternal colostrum that initially had 20% Brix but was enriched to 25% Brix using a colostrum replacer (Saskatoon, SK, Canada; SCCL) (Silva et al., 2024).

The final results of this study found no differences between the calves regarding serum IgG concentration, total serum protein, apparent efficiency of IgG absorption, concentrate intake, daily weight gain, body weight, or variables related to the health status of the calves.

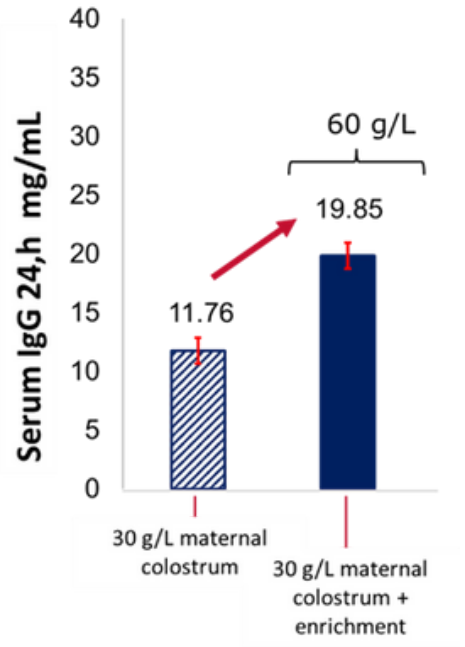

Figure 3. Modified from Lopez et al. (2023).

These results demonstrate that improving the quality of maternal colostrum through enrichment with a colostrum replacer is possible, as evidenced by the lack of differences in serum IgG levels, health status, and productivity in the calves across both treatments.

At SCCL, there are a series of recommendations for enriching colostrum on the farm. It is considered that any colostrum with a Brix percentage of 22% or lower should be enriched to achieve an adequate IgG mass. Table 1 shows the classification of colostrum based on its Brix percentage and the corresponding recommendation.

BRIX %	QUALITY	RECOMMENDATION
<22%	Poor	Enrich with colostrum replacer
22-25%	Adequate	Enrich with colostrum replacer
25-30%	Good	Enrich for excellent results (↓ mortality)
>30	Excellent	No enrichment

Table 1. Recommendations for enriching maternal colostrum with a colostrum replacer.

To know exactly how much colostrum replacer we need to add to our maternal colostrum, we first need to determine the Brix percentage of the colostrum we are working with. This can be done using a refractometer, which will quickly provide us with a reading based on the quality of our colostrum.

Additionally, we need to set the target Brix percentage we want to achieve with the enrichment. Our goal should always be to obtain colostrum that falls between 25-30% Brix. Once we know the Brix percentage of our colostrum (what we have) and our enrichment goal (what we want to reach), we can use Table 2 as a reference to determine how many grams of SCCL colostrum replacer we need to add to our maternal colostrum.

		Set target for desired colostrum brix % (1L)								
Maternal colostrum (1L)	Brix	22%	23%	24%	25%	26%	27%	28%	29%	30%
	16%	90g	105g	120g	135g	150g	165g	180g	195g	210g
	17%	75g	90g	105g	120g	135g	150g	165g	180g	195g
	18%	60g	75g	90g	105g	120g	135g	150g	165g	180g
	19%	45g	60g	75g	90g	105g	120g	135g	150g	165g
	20%	30g	45g	60g	75g	90g	105g	120g	135g	150g
	21%	15g	30g	45g	60g	75g	90g	105g	120g	135g
	22%	0g	15g	30g	45g	60g	75g	90g	105g	120g
	23%	-	0g	15g	30g	45g	60g	75g	90g	105g
	24%	-	-	0g	15g	30g	45g	60g	75g	90g
	25%	-	-	-	0g	15g	30g	45g	60g	75g
	26%	-	-	-	-	0g	15g	30g	45g	60g
	27%	-	-	-	-	-	0g	15g	30g	45g
	28%	-	-	-	-	-	-	0g	15g	30g
	29%	-	-	-	-	-	-	-	0g	15g
	30%	-	-	-	-	-	-	-	-	0g

Table 2. Colostrum powder calculations to enrich fresh colostrum.

Don't neglect the fundamentals of proper colostrum management.

Enriching low-quality maternal colostrum is a practical and effective tool that ensures an optimal and uniform start for all newborn calves. However, to achieve ideal results, it's important not to forget that proper colostrum management generally involves applying a protocol with an emphasis on four main points (Figure 4).

1.Timing of administration → within the first 2 hours, with a second feeding within the first 12 hours.
2. Colostrum quality → IgG concentration above 50 g/L.
3. Colostrum quantity → a first feeding equivalent to 10% of body weight in kg + a second feeding equivalent to 5% of body weight.
4. Colostrum cleanliness → low pathogen load or bacterial counts.

Finally, it is essential that when enriching colostrum, a colostrum replacer derived directly from maternal colostrum is used. This ensures that the product retains the essential characteristics of natural colostrum, without the addition of additives or the removal of crucial components.

An appropriate replacer should maintain the natural levels of fat, protein, immunoglobulins, and bioactive compounds present in maternal colostrum. In this way, it ensures that the calves receive nutrition and immune protection like what they would obtain from natural maternal colostrum, maximizing the benefits for their health and development.

Figure 4. Key points of an adequate colostrum management protocol.

Conclusion

The significant variability in colostrum quality among cows within the same farm makes it difficult to rely exclusively on farm colostrum for calf nutrition. Enriching with colostrum replacer is a proven method to improve IgG and nutrient content in maternal colostrum, ensuring more consistent and higher-quality colostrum. By improving colostrum quality, farmers can enhance the passive transfer of immunity, reduce disease incidence, and decrease morbidity and mortality rates. Calves that receive enriched colostrum are better prepared to fight infections, require fewer antibiotics, and have higher survival rates. Investing in colostrum replacer products not only promotes calf health but also reduces veterinary costs and improves long-term production, contributing to the development of more sustainable dairy industries.

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