Colostrum Management and Impacts on Calf Health

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Why is Colostrum Management Important?

Calves are born without a fully functional immune system, making high-quality colostrum the primary source of antibodies (immunoglobulins) and bioactive components that protect calves from infections and promote gut development. **Providing all calves on the farm—whether replacement heifers or non-replacement calves destined for purposes beyond dairy—with sufficient amounts of high quality colostrum is essential.**

What is Transfer of Passive Immunity?

Transfer of passive immunity refers to the transfer of immunoglobulins from colostrum to the bloodstream of the calf. The success of transfer of passive immunity from dam to calf can be measured on farm and is a good starting point to evaluate colostrum management programs.

Measuring Transfer of Passive Immunity

1. Blood samples are taken from calves that are one to seven days old.
2. Blood can be left in the fridge overnight or spun in a centrifuge. Serum is tested using a refractometer to determine the level of serum total protein or Brix %. Alternatively, blood samples can be sent to a lab to determine immunoglobulin G (IgG) levels.
3. The levels of total protein and Brix % that correspond to the passive immunity categories are highlighted in Table 1. Target ranges established by Lombard *et al.* (2020)[1] outline the ideal proportion of calves in each category, aiming to minimize the incidence of disease.

Table 1. Levels of IgG, serum total protein, and Brix % in different passive immunity categories.

	Serum IgG (g/L)	Serum total protein (g/dL)	Brix %	Category Target (% of all calves)
Excellent	25 +	6.2 +	9.4 +	>40%
Good	18 - 24.9	5.8 - 6.1	8.9 - 9.3	~ 30%
Fair	10 - 17.9	5.1 - 5.7	8.1 - 8.8	~ 20%
Poor	< 10	< 5.1	< 8.1	< 10%

What is the Link Between Passive Immunity and Disease?

To answer this question, results from several studies were combined to represent 10,130 dairy heifers[1-3]. Calves with **poor** passive immunity had a significantly higher risk of disease compared to calves with **fair, good,** and **excellent** passive immunity levels (**Figure 1**). In contrast, calves in the **excellent** category had the lowest disease rates among the groups. This pattern was consistent for treatments related to diarrhea and respiratory disease. Calves in the **poor** category also had a 6% mortality rate, compared to 3% in **fair** and 2% in both **good** and **excellent** categories. Beyond heifer calves, non-replacement calves moving off the farm also benefit from high levels of passive immunity, which has been found to reduce their risk of illness and improve their welfare[4].

Level of disease treatment by passive immunity status

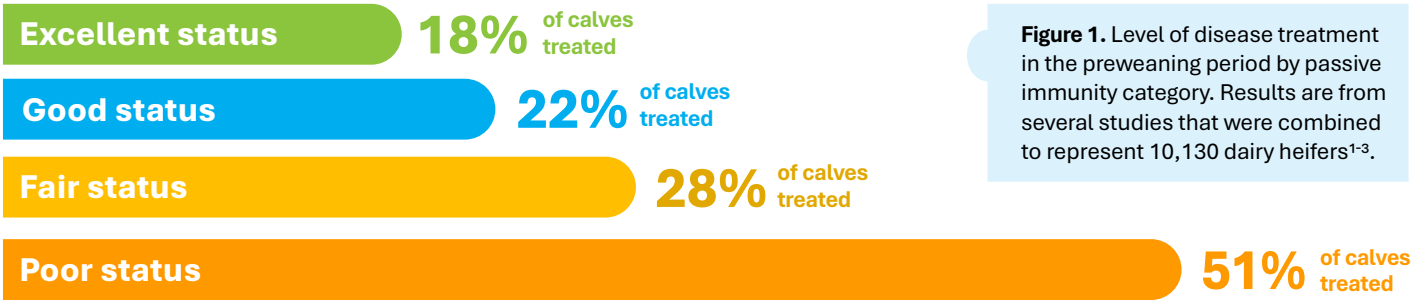

Figure 1. Level of disease treatment in the preweaning period by passive immunity category. Results are from several studies that were combined to represent 10,130 dairy heifers[1-3].

What is the Current Rate of Passive Immunity Status in Canadian Calves?

Table 2 outlines results of the studies and compares them to targets for each category. Fairly comparable results can be seen across the country, with an opportunity to improve passive immunity identified.

Table 2. Levels of passive immunity in calves in Ontario (846 calves from 105 farms)[5], British Columbia (1,433 calves from 55 farms)[6], and Québec (818 calves from 61 farms)[7] from 2016 to 2021.

	Ontario	British Columbia	Québec*	Category Target (% of all calves)
Excellent	32%	31%	68%	>40%
Good	17%	17%		~ 30%
Fair	32%	28%		~ 20%
Poor	19%	24%	32%	< 10%

* Used a threshold of > 8.4% on the Brix scale, meaning not directly comparable to the different categories. Categories < 8.4% were merged into the Poor category, and those > 8.4% were merged into the Fair, Good, and Excellent categories.

Although these studies demonstrate room to improve passive immunity of calves, important positive changes have occurred over the past 15 years. A study conducted in Ontario[8] in 2004 sampled 422 calves on 119 dairy farms and found that 37% had poor levels of passive immunity. In comparison, only 19% of calves were in that category in 2019.

What Can Farms do to Improve Passive Immunity?

Passive immunity can be improved with better colostrum practices. This can enhance growth, lower disease rates, and increase survival.

Colostrum Quantity

The quantity of colostrum offered to calves is critical to ensure they receive enough immunoglobulins to build strong passive immunity.

Dairy calves should receive 8.5% to 10%[9] of birth body weight in colostrum (i.e., for a 40kg calf, it should receive between 3.4 to 4 L of colostrum) at the first feeding. This boosts their immune system, protecting them from disease during early life.

Providing a second colostrum feeding[10] has been shown to boost immunoglobulin levels in the bloodstream. Further, calves receiving a second meal of colostrum, compared to those that received a single meal, were:

- **2 times less likely** to be diagnosed with respiratory disease
- **3 times less likely** to be diagnosed with diarrhea
- **2.3 times less likely** to have any disease before weaning

Colostrum Quality

Colostrum quality is just as important as quantity to ensure passive immunity. The concentration of immunoglobulins, particularly IgG, should be high to boost passive immunity.

As an example, a study[11] offered differing qualities of colostrum (poor = 30 g/L; moderate = 60 g/L; excellent = 90 g/L) to calves, finding that **despite feeding the same volume of colostrum (3.8 L), serum IgG increased substantially as colostrum quality increased.**

Testing colostrum quality before feeding helps ensure calves receive the best possible start. A Brix refractometer is one method of testing for quality, and it requires only a drop of colostrum. **If the Brix scale indicates a value of 22% or more, the colostrum is at least moderate quality colostrum and should be fed.** If surplus of that colostrum is available, it can be stored for future needs (refrigerated for less than 2 days or frozen for less than 1 year). If the Brix scale indicates a value below 22%, the colostrum should not be fed. If no other source of high-quality colostrum is available, adding colostrum replacer to the colostrum can improve its quality or colostrum replacer can be fed on its own.

Quickness of Colostrum Feeding

While it is not always possible to feed colostrum immediately after birth, it should be offered as soon as possible. **First feedings should ideally occur within the first 3 hours after birth and no later than 6 hours.** If colostrum is not fed within 3 hours of birth, calves are **1.6 times more likely** to be in the poor category of passive immunity (**Table 1**). Second feedings should occur within 12 hours after birth.

Colostrum Cleanliness

Bacteria in colostrum can interfere with the calf's ability to absorb IgG. Fresh raw colostrum fed to calves should have a total bacteria count of less than 100,000 colony-forming units (cfu)/mL and a total coliform count of less than 10,000 cfu/mL. **To minimize contamination of colostrum, clean and sanitize udders, collect colostrum into a clean, sanitized bucket and use clean, sanitized feeding equipment.** Further, if colostrum is not fed immediately, it should be frozen or refrigerated within 1 hour, as bacteria multiply quickly at warm temperatures[12].

Quantifying Success of Transfer of Passive Immunity

Assessing the performance of a colostrum management program is key to improving calf health outcomes. **Regularly evaluating the success of transfer of passive immunity and tracking improvements can help to identify impactful practices and interventions.** A herd veterinarian can help take blood samples, interpret data, and suggest opportunities to further improve.

Can Extended Colostrum or Transition Milk Feeding Have an Impact?

After the first colostrum feedings, providing transition milk (milk from the dam's 2nd to 6th milking after calving) or small amounts of colostrum or colostrum replacer offers important benefits. Transition milk contains higher levels of nutrients, immunoglobulins, and other essential components that support health and development as compared to whole milk. Studies show that feeding calves transition milk or a small amount of colostrum for 4 to 14 days of age can lead to:

- ✓ Improved development of the intestines
- ✓ Fewer cases and severity of diarrhea
- ✓ Improved survival
- ✓ Higher growth rates

Key Takeaways

- Aim to give calves at least 8.5 to 10% of birth body weight in colostrum within the first 3 hours after birth and consider a second feeding within 12 hours to further boost passive immunity and reduce disease.
- Test colostrum quality with a Brix refractometer, targeting a reading of 22% or higher, and ensure colostrum is clean to prevent bacterial interference with immunoglobulin absorption.
- Passive immunity can be evaluated by analyzing blood samples from calves aged 1 to 7 days.
- Effective colostrum management is essential for calf health, as colostrum provides crucial immunoglobulins for passive immunity and other bioactive components for the calf's health and development.

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