

Colostrum Management for Dairy Calves: Key Practices for Calf Health and Performance

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Highlights

- Calves are born without immunity and rely entirely on colostrum for protection.
- Colostrum is more than just milk. It delivers essential antibodies, nutrients, and growth-supporting compounds that are critical for calf survival, health, and performance.
- Always test colostrum and don't rely on appearance. Use a Brix refractometer and aim for #22% Brix to ensure high-quality colostrum.
- Feed 3–4 L (4 quarts) of colostrum as soon as possible after birth. If the calf doesn't drink enough, use a tube feeder to make sure it gets the full amount.
- Feed colostrum within 1–2 hours of birth. The sooner the better, maximizing antibody absorption and calf health.
- Fresh colostrum should contain <100,000 CFU/milliliters total plate count and <10,000 CFU/milliliters coliforms. To further reduce bacteria and improve passive transfer, consider heat-treating colostrum.
- Check passive transfer at 24–48 hours of age using IgG, total protein, or Brix. Use excellent, good, fair, and poor categories instead of a single cutoff.

This fact sheet provides practical recommendations to improve colostrum management and support calf health and performance.

The Importance of Colostrum and What's in It

Colostrum is the “first milk” a cow produces after calving, and it is the most important first meal a calf will receive. It provides the nutrients and immune protection calves need to get off to a strong, healthy start (Godden et al., 2019).

Calves are born without an immune system to protect against disease because the ruminant placenta prevents the transfer of maternal antibodies. This means that calves rely entirely on colostrum to receive those antibodies (Barrington & Parish, 2001).

Key takeaway: Calves are born without immunity and rely entirely on colostrum for protection.

Immunoglobulins

One of the most important parts of colostrum is antibodies, especially **Immunoglobulin G (IgG)**. IgG is the most abundant immunoglobulin found in colostrum. The IgG is an antibody that helps protect calves from common diseases during their first weeks of life (Larson et al., 1980), when the immune system is still developing.

Immune Cells

Colostrum also contains white blood cells (leukocytes) (Duhamel et al., 1987), which may help support early immune system development. However, their direct effects on disease prevention are less clear (Godden et al., 2019).

Nutrients and Energy

Colostrum is more energy- and nutrient-dense than milk. It contains higher levels of protein, fat, vitamins, and minerals than milk (Foley & Otterby, 1978), which provide the energy calves need to stay warm, grow, and maintain normal body functions immediately after birth (Hammon et al., 2013).

Other Beneficial Components

In addition to nutrients and antibodies, colostrum contains compounds like growth factors and antimicrobial proteins that help develop the calf's digestive system and immune system (Godden et al., 2019).

Key takeaway: Colostrum is more than just milk. It delivers essential antibodies, nutrients, and growth-supporting compounds that are critical for calf survival, health, and performance.

Evaluating Colostrum Management

Colostrum only works if it is managed correctly. Correct management means calves need to receive it quickly, in the right amount, with adequate antibody concentration, and clean. If not, calves may not receive sufficient immunity, increasing the risk of disease and death early in life.

To build strong immunity, calves must achieve **adequate passive transfer** (see the “Colostrum Monitoring” section). To achieve adequate passive transfer, calves must absorb enough IgG shortly after birth.

- **Minimum goal:** 150–200 g of IgG to achieve adequate passive transfer.
- **Target for best results:** 300 g or more (Godden et al., 2019).

Good colostrum management comes down to four concepts:

- **Quality:** Is colostrum high in IgG? (Use a Brix refractometer; aim for #22%.)

- **Quality:** Is colostrum high in IgG? (Use a Brix refractometer; aim for #22%.)
- **Quantity:** Did the calf get enough volume? (Provide about 4 quarts for Holsteins at the first feeding.)
- **Quickness:** Was colostrum fed soon after birth? (Feeding within 2 hours is best.)
- **Cleanliness:** Was colostrum clean? (This means low bacteria; use clean equipment and proper storage.)

Multiple factors influence passive transfer. Colostrum quality, quantity, quickness, and cleanliness should all be evaluated through passive transfer monitoring. Checking and managing these factors regularly will help make sure your colostrum program is working.

Colostrum Quality

Colostrum contains many important components, but IgG is the main measure of quality. High-quality colostrum is defined as #50 g/L IgG (Godden et al., 2019).

Colostrum quality can vary widely between cows, ranging from approximately 25 g/L (low end) to over 130 g/L (high end) based on reported percentiles. Because of this variation, colostrum quality should always be measured, not guessed.

Several factors influence colostrum quality (Godden et al., 2019).

Visual appearance (color or thickness) is not a reliable way to judge quality (Maunsell et al., 1999).

- **Lactation:** Older cows usually produce higher-quality colostrum than first-calf heifers.
- **Timing of collection:** Quality decreases if colostrum is not collected soon after calving.
- **Dry period length:** Very short dry periods can reduce colostrum quality and volume, with cows dried for 28 days producing less colostrum than cows dried for 60 days (Javani et al., 2023).
- **Heat stress:** High temperatures before calving can lower IgG levels.
- **Vaccination:** Pre-calving vaccination increases specific antibodies in colostrum.

A **Brix refractometer** is a simple on-farm tool used to estimate IgG levels. It measures total solids and provides a quick way to assess colostrum quality. A reading of #22% Brix indicates high-quality colostrum (#50 g/L IgG) (Buczinski & Vandeweerd, 2016).

Key takeaway: Always test colostrum and don't rely on appearance. Use a Brix refractometer and aim for #22% Brix to ensure high-quality colostrum.

Colostrum Quantity

Newborn calves should receive 10%–12% of their body weight in colostrum at the first feeding. For a Holstein calf, this equals about 3–4 L (4 quarts) (Godden et al., 2019).

Feeding a larger volume at the first feeding improves passive transfer. For example, calves fed 4 liters shortly after birth, followed by 2 L 12 hours later, had higher IgG levels than calves fed 2 L at the first feeding (Morin et al., 1997). Providing more colostrum early has also been linked to better growth and higher milk production later in life (Faber et al., 2005).

Colostrum can be delivered using either a nipple bottle or an esophageal tube feeder. Both feeding methods can result in adequate passive immunity when calves receive sufficient volume (Godden et al., 2009; Desjardins-Morrisette et al., 2018). However, a study reported that calves drinking from a nipple bottle may consume only about 2.2 L of colostrum on average (Chigerwe et al., 2012). Therefore, producers should be prepared to tube feed the remaining colostrum to ensure calves receive the full recommended amount.

Key takeaway: Feed 3–4 L (4 quarts) of colostrum as soon as possible after birth. If the calf doesn't drink

enough, use a tube feeder to make sure it gets the full amount.

Colostrum Quickness

A calf's ability to absorb antibodies is highest right after birth and declines quickly over time. By about 24 hours, the gut is effectively "closed," meaning very little antibody absorption can occur (Stott et al., 1979).



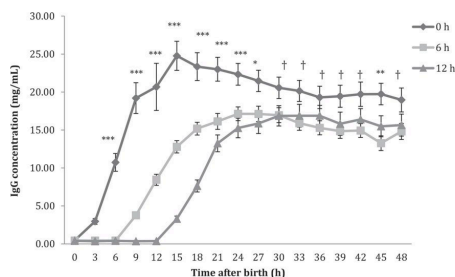
Due to this, colostrum should be fed as soon as possible after birth.

- **Best:** within 1–2 hours.
- **Acceptable:** within 4 hours.
- Absorption drops significantly after 12 hours (Stott et al., 1979; Weaver et al., 2000).

Research shows that feeding colostrum earlier leads to higher IgG levels in calves, even when compared to feeding at 6 or 12 hours after birth (Fischer et al., 2018).

In one study, calves fed colostrum within the first hour of life had higher serum IgG concentrations than calves first fed at 6 or 12 hours, with differences lasting through 48 hours (Figure 1).

Figure 1. Effect of Delaying Colostrum Feeding by 0 (fed within first hour of life), 6, or 12 Hours on Serum Concentrations of IgG (mg/mL) Relative to Time of Birth



Note. Points represent mean $\pm$ SEM. *** $P < 0.001$, ** $0.001 < P < 0.01$, * $0.01 < P < 0.05$, † $0.05 < P < 0.10$.

Source: Fischer et al., 2018

Key takeaway: Always test colostrum and don't rely on appearance. Use a Brix refractometer and aim for #22% Brix to ensure high-quality colostrum.

Colostrum Cleanliness

Bacteria in colostrum can reduce how well calves absorb antibodies. High bacterial levels, especially coliforms, can bind or block immunoglobulins in the gut, lowering passive transfer (James et al., 1981). Several studies have also shown that higher bacterial contamination is associated with reduced immunoglobulin absorption in calves (Godden et al., 2012; Morrill et al., 2012).

Colostrum should meet the following cleanliness standards (McGuirk and Collins, 2004):

- Total plate count (TPC): <100,000 **colony-forming units (CFU)**/milliliter.
- Coliforms: <10,000 CFU/mL (McGuirk and Collins, 2004).

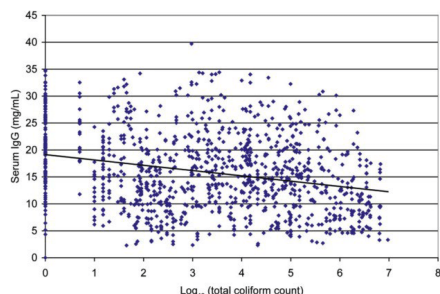
Heat-treating colostrum at 60 °C (140 °F) for 60 minutes can significantly reduce bacteria while maintaining IgG levels and colostrum quality (Godden et al., 2006; McMartin et al., 2006; Donahue et al., 2012). This is done using a pasteurizer or controlled heating system to maintain a constant temperature.

Reducing bacterial contamination improves calf health outcomes. For example, calves fed heat-treated colostrum had (Godden et al., 2012):

- **Lower failure of passive transfer:** 30.1% (raw) vs. 18.6% (heat-treated).
- **Fewer illness treatments:** 36.5% (raw) vs. 30.9% (heat-treated).
- **Lower scours incidence:** 20.7% (raw) vs. 16.5% (heat-treated).

Higher bacterial counts were also associated with lower IgG absorption in calves (Figure 2).

Figure 2. Negative Relationship Between Colostrum Total Coliform Count ($\log_{10}$ cfu/mL) and Calf Serum IgG (mg/mL)



Note. $P < 0.0001$

Source: Godden et al., 2012

Key takeaway: Fresh colostrum should contain <100,000 CFU/mL total plate count and <10,000 CFU/mL coliforms. To further reduce bacteria and improve passive transfer, consider heat-treating colostrum.

Colostrum Monitoring



Monitoring passive transfer is the best way to determine if your colostrum management program is working. This is typically done by measuring serum IgG or total protein in calves at 24–48 hours of age. For more information on passive transfer, see the USU Extension fact sheet “Colostrum and Rethinking Passive Transfer in Dairy Calves.”

Traditionally, failure of passive transfer was defined as serum IgG <10 g/L (Godden et al., 2019). However, newer recommendations use categories to better evaluate passive transfer (Lombard et al., 2020), with equivalent values for IgG, serum total protein, and Brix shown in Table 1.

On-farm, passive transfer is most commonly assessed using serum total protein or a Brix refractometer, which provides practical estimates of IgG levels.

Table 1. Consensus Serum IgG Concentrations and Equivalent Serum Total Protein (TP) and Blood Brix Measurements, and Percentage of Calves Recommended in Each Transfer of Passive Immunity (TPI) Category

TPI category	Serum IgG (g/L)	Equivalent TP (g/dL)	Equivalent % Brix	Consensus target (% calves)
Excellent	#25.0	#6.2	#9.4	>40
Good	18.0–24.9	5.8–6.1	8.9–9.3	~30
Fair	10.0–17.9	5.1–5.7	8.1–8.8	~20
Poor	<10.0	<5.1	<8.1	<10

Source: Lombard et al., 2020

Key takeaway: Check passive transfer at 24–48 hours of age using IgG, total protein, or Brix. Use *excellent*, *good*, *fair*, and *poor* categories instead of a single cutoff.

Summary

Colostrum is the first and most important feeding a newborn calf receives, providing essential antibodies, nutrients, and bioactive compounds that support immunity, gut development, and early growth. Because calves are born without circulating antibodies, successful transfer of immunity depends entirely on proper colostrum management.

Effective colostrum programs focus on the colostrum quality, quantity, quickness, and cleanliness. Providing high-quality, clean colostrum in adequate amounts as soon as possible after birth improves passive transfer and reduces disease risk in young calves.

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