Practical rules and tools of colostrum management

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Abstract

Colostrum management, from administration of dry cow vaccines to harvesting, feeding, and monitoring its success, is a significant opportunity for direct veterinary involvement and oversight on all dairy herds. It is well known there is a critical need for colostrum to provide calories and a source of immunoglobulins for transfer of immunity from dam to her naïve offspring. The purpose of this article is to review practical steps for helping dairy clients achieve these new guidelines, from the dry period to colostrum harvest, feeding, and monitoring colostrum programs.

Key words: colostrum, management, passive transfer

Introduction

Colostrum plays a pivotal role in influencing the metabolic and endocrine systems, both of which are influenced by the gastrointestinal tract's surface area for absorption of nutrients[13] and quality of gut microbiome[4]. Recent guidelines proposing higher levels of serum IgG (g/L)[7] when assessing passive transfer rates are achievable for well-managed farms with proven calf benefits relating to mortality, health, growth, and longevity.[16] This presentation reviews 9 practical steps for helping dairy clients achieve the new guidelines for colostrum management from the dry period to colostrum harvest, feeding, and monitoring colostrum programs.

1. **Specific management factors are known to have a negative impact on colostrum.** Stressors such as overcrowding and heat during the dry period not only impact colostrum quality, but recent work has demonstrated reduced ability for calves born from dams experiencing heat stress to absorb colostral IgG[3]. In addition, a short dry period (less than 21 days) should be avoided to allow enough time for sequestration of IgG in the mammary gland during colostrogenesis, especially if administering vaccines targeted to protect the newborn calf against scours-causing pathogens through colostral antibodies. A shortened photoperiod, such as one that occurs because of diminishing day length during autumn and winter, may also be associated with reduced colostrum production[5]. Herds that experience a seasonal shortage of colostrum should prepare for inadequate colostrum yield by feeding colostrum replacer or banking and freezing extra colostrum. Delayed colostrum harvest can dilute colostral IgG concentration by up to 20% at 6 hours post-parturition[12]. Producers should be aware that parity of dam does not dictate colostrum quality. Colostrum from primiparous dams has been shown to be comparable to multiparous cows and can be fed to calves.[15]
2. **Focus on timely, clean colostrum collection.** Colostrum harvest should occur within 1 hour after calving. Heat-treating colostrum (140°F, or 60°C for 60 minutes) should be considered for herds with goals to reduce transmission of diseases such as *M. Avium* subsp *paratuberculosis, E. coli*, *Salmonella* spp, and *Mycoplasma* spp. Pay special attention to the cleanliness of the colostrum collection bucket, milking unit, and all feeding equipment used for colostrum. This equipment should be cleaned and sanitized between all cows and calves. Evaluate cleaning processes using an ATP luminometer for real-time feedback of protocol compliance.
3. **Feed 4 quarts of high-quality colostrum in the first 2 hours of life.** Feed clean colostrum that measures greater than 22% BRIX (>50 g/L IgG), providing at least 150 to 300g IgG[7]. Delayed first-colostrum feeding by more than 6 hours significantly reduces the newborn calf's ability to absorb colostral IgG, and thus overall serum IgG concentration[4]. Calves can be fed colostrum via esophageal tube or bottle; both are equally effective at transferring immunoglobulins when a volume of colostrum greater or equal to 3 quarts is fed to calves[6]. Goals for bacteria levels in fresh colostrum are less than 100,000 cfu/mL total plate count and 10,000 cfu/mL total coliform count[11].
4. **Colostrum should be prepared for storage if not fed within 1 hour following collection.** Bacterial numbers in colostrum can double within 20 minutes. Cool promptly and store colostrum in containers labeled with harvest date, BRIX %, and donor name/number. Colostrum can be refrigerated at 40°F (4°C) for up to 7 days with addition of potassium sorbate, or frozen for up to 1 year.
5. **Reheat stored colostrum without destroying IgG.** Avoid water temperatures greater than 140°F (60°C), which will denature IgG proteins. Temperature-controlled water baths can be made with a 50-quart cooler and sous vide/immersion cooker. The process of thawing and reheating 1 gallon of colostrum using this system is approximately 30 to 40 minutes, depending on storage container.
6. **Be prepared when colostrum is unavailable due to inadequate quality and/or quantity.** The first option is to feed stored colostrum from a donor. The

second option is to feed a high-quality colostrum replacer. Herd veterinarians should recommend clients provide at least 150g IgG in the first feeding when using colostrum replacer and follow manufacturer's guidelines for serum total protein (STP, g/dL) cut points that reflect serum IgG levels associated with successful or failure of passive transfer. Manufacturer's guidelines for a specific colostrum replacer product should not be extrapolated to another product.

7. **Monitor colostrum management.** Direct measurement of serum IgG (g/L) via radial immunodiffusion remains the gold standard for assessing passive transfer status of immunity. Other more practical, calf-side tools such as a refractometer to measure STP (g/dL) can be used to determine failure of passive transfer status at the herd level. Another option is a BRIX refractometer, which can be used cow-side to measure BRIX (%) content of colostrum and calf-side to measure blood BRIX (%). To survey a herd's colostrum management program, draw blood from 12 calves, ages 1 to 7 days of age, and evaluate serum using a refractometer. Since STP and BRIX are proxies of serum IgG (g/L), it is recommended these are only used for overall colostrum management analysis and not individual calf health decisions. Note that dehydration, systemic inflammation, and age can impact refractometry results. Table 1 illustrates the most recent proposed goals of serum IgG status recommended for producers to benchmark their herd's colostrum program and overall passive transfer status[7].
8. **Add supplemental colostrum to scours prevention and treatment protocols.** Consider a second feeding of colostrum 6 to 12 hours after the first feeding to boost serum IgG concentrations[8] if calves are not reaching new recommendations defined in Rule #7 or calves are raised in a system associated with increased health challenges. Feeding colostrum after gut closure provides a source of local IgG for protection against scours-inducing pathogens and growth factors for enhanced gastrointestinal tract development[13]. Providing supplemental colostrum has been associated with reduced morbidity and treatments[2] as well as improved weight gain in the first month of life[1]. Practical implementations of providing supplemental colostrum on-farm include the following:
   a. Freeze colostrum (BRIX % >20) in ice cube trays and add 2 cubes per feeding to milk or milk replacer
   b. Feed desired amount of IgG using colostrum replacer (20 to 64g IgG per day have proven benefits[1,2])
   c. Incorporate transition milk (first 6 feedings) into pasteurized milk or collect separately and feed transition milk for the first 3 days of life
   d. Feed a milk replacer containing plasma as part of the protein profile[14]
9. **Promote and praise consistency in colostrum management.** Build a management team dedicated to colostrum management and early life calf health. Making the effort in maternity to ensure each calf is provided with clean colostrum to promote adequate passive transfer of immunity will save time and money for those involved in calf care and beyond.

Conclusion

The maternity area on any dairy is one in which all cows and calves must spend a short, although crucial, amount of time. Thus, maternity and colostrum management are critical areas for all veterinarians to provide direct oversight for dairy clients and their cattle. For recent veterinary graduates, training of maternity protocols such as calving assistance, tubing colostrum, and drawing blood provides an opportunity for relationship-building that is not only essential for new veterinarians and their clients, but often for the success of a herd's colostrum program.

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Table 1. Proposed recommendations for assessing herd-level successful passive transfer rates.

Serum IgG status	IgG conc. (g/L)	Equivalent STP levels (g/dL)	Equivalent serum BRIX levels (%)	Calves in each category (%)
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

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