United States Department of Agriculture

Colostrum Feeding and Management on U.S. Dairy Operations, 1991-2014

Information Brief

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INTRODUCTION

Colostrum feeding and management are essential to raising healthy calves on any dairy operation. Colostrum, or the first secretion from the mammary gland, provides essential nutrients and passive immunity to calves through immunoglobulins. Colostrum is critical for calves to resist infections in the first few weeks of life. Colostrum also contains important nutrients, such as energy, protein, fat, vitamins, minerals, and provides heat when fed at body temperature.

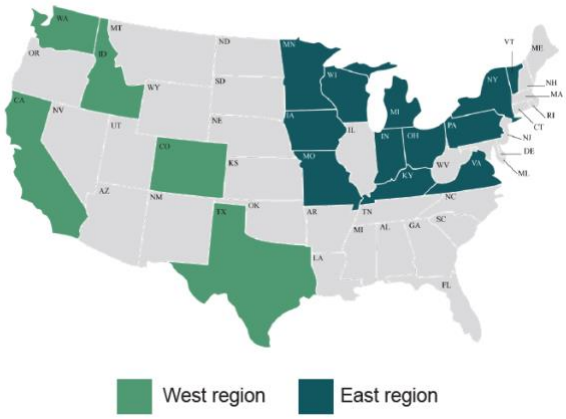
Implementing management practices such as feeding methods, measuring colostrum quality, colostrum storage, and heat-treating colostrum can all impact the health of calves. This information brief provides information on colostrum feeding and management on U.S. dairy operations from 1991 to 2014, provides current recommendations for colostrum feeding and management, and highlights improvements made by the dairy industry.

NAHMS DAIRY 2014 STUDY

U.S. Department of Agriculture's National Animal Health Monitoring System (NAHMS) conducted the Dairy 2014 study, which collected data on dairy health and management practices from 17 of the Nation's major dairy States (figure 1). These States represented 80.5 percent of U.S. dairy operations and 81.3 percent of U.S. dairy cows in 2014.

Dairy 2014 is the fifth national study of the U.S. dairy industry conducted by NAHMS. Previous studies include the 1991 National Dairy Heifer Evaluation Project (NDHEP), Dairy 1996, Dairy 2002, and Dairy 2007. Consistent with the previous studies, Dairy 2014 surveyed dairy producers about their colostrum feeding and management practices.

Figure 1. States/regions that participated in the NAHMS Dairy 2014 study



West region: California, Colorado, Idaho, Texas, Washington
East region: Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Vermont, Virginia, Wisconsin

IMPORTANCE OF COLOSTRUM

Maternal immunoglobulins are essential for protecting all young animals from disease. Most mammals receive immunoglobulins in utero across the placenta; however, calves are born with no immunoglobulins. Colostrum provides essential nutrients and passive immunity to calves through immunoglobulins, primarily immunoglobulin G (IgG). Colostrum is critical for calves to resist infections in the first few weeks of life. Colostrum also contains important nutrients, such as energy, protein, fat, vitamins, minerals, and supplemental heat.

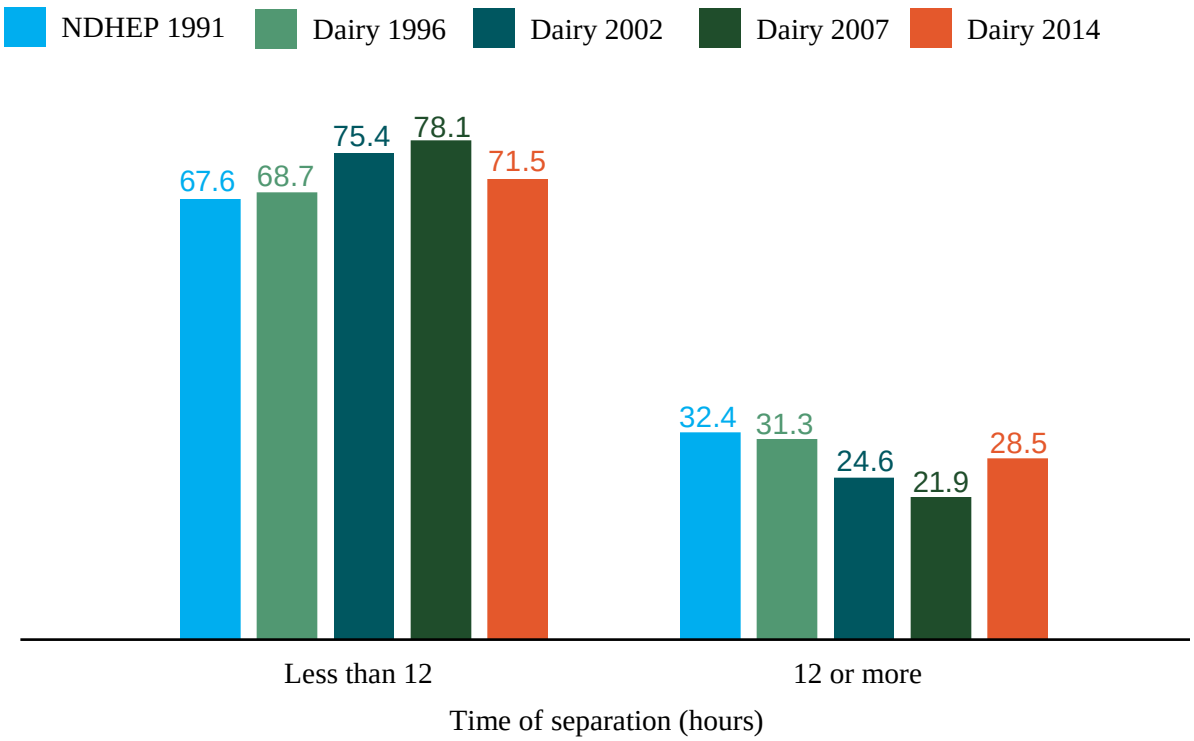
The four most important factors related to colostrum management are colostrum quality, quantity, timing of feeding, and cleanliness.[1] Failure of passive immunity has been shown to increase calf morbidity and mortality and decrease calf growth.[2,3] Failure of passive immunity can also decrease productivity, including decreased first and second lactation milk production and increased culling rate during the first lactation.[4,5]

SEPARATING CALVES FROM DAMS

Separating a calf from its dam is important for the welfare of both animals. Separation helps prevent the transmission of disease, ensures adequate consumption of colostrum, and prevents potential injury and death. For example, separation could prevent a calf from ingesting feces, bedding, or other materials in the environment contaminated by a cow infected with *Mycobacterium avium* subspecies *paratuberculosis*, the causative agent of Johne's disease.

In 2014, 10.6 percent of operations - accounting for 26.0 percent of calves - separated calves from their dam in less than 1 hour. Allowing a calf to suckle colostrum directly from its dam presents challenges, such as being unable to ensure the calf receives an appropriate amount of colostrum. It is also impossible to estimate the quantity of antibodies ingested by the calf. The majority of operations in all study years removed calves less than 12 hours following birth (figure 2).

Figure 2. Percentage of operations by time following birth that calves were normally separated from their dams

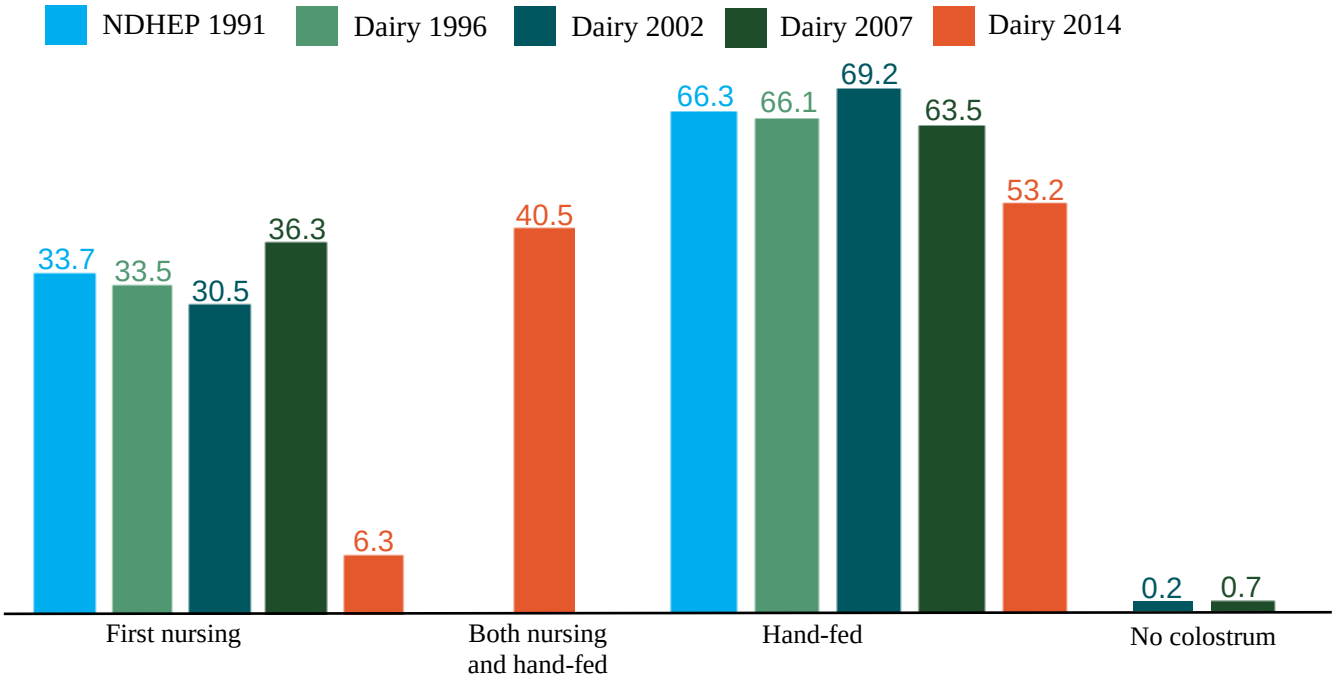


COLOSTRUM FEEDING

Protective immunoglobulins (such as IgG) in colostrum are absorbed across the gut into the bloodstream, resulting in transfer of passive immunity. Colostrum must be fed soon after birth as the lining of the gut begins to close by 24 hours of age, and immunoglobulins can no longer be absorbed.[6] In 2014, heifer calves were given their first feeding of colostrum on average 3.6 hours following birth compared with 3.3 hours in 2007.

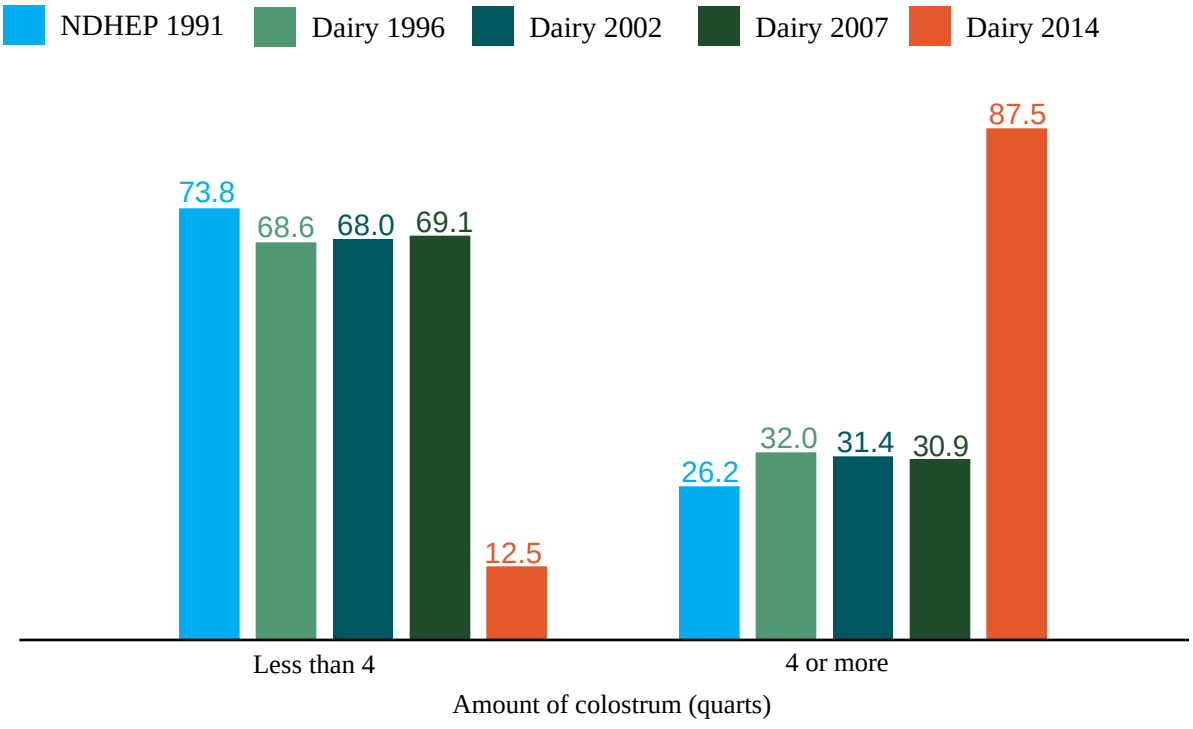
Hand-feeding colostrum ensures that the calf receives an adequate amount of colostrum to provide immunity.[7] In 2014, 53.2 percent of operations – accounting for 81.6 percent of heifer calves – administered colostrum via hand feeding only; 40.5 percent of operations – accounting for 15.7 percent of calves –allowed calves to nurse the cow and hand-fed colostrum; the remaining 6.3 percent of operations – accounting for 2.7 percent of calves – allowed calves to nurse the cow only (figure 3).

Figure 3. Percentage of operations by method normally used for calves' first feeding of colostrum



Current recommendations are to feed 4 quarts of colostrum within the first 4 hours of life to ensure adequate transfer of passive immunity.[8] For operations that normally hand-fed colostrum, the percentage of operations that fed 4 or more quarts of colostrum within the first 24 hours increased in 2014 compared to previous studies (figure 4).

Figure 4. For operations that normally hand-fed colostrum, percentage of operations by amount of colostrum normally fed during the first 24 hours

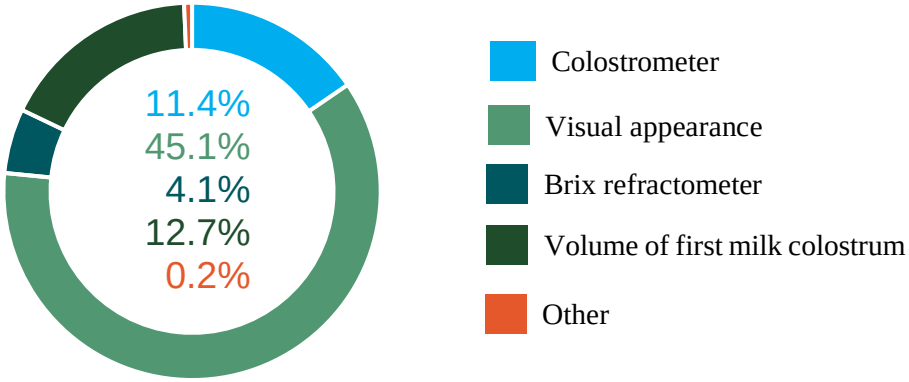


COLOSTRUM CLEANLINESS AND QUALITY

In addition to providing calves with important immunoglobulins, colostrum can also be a route of disease transmission from cow to calf. High quality colostrum contains adequate concentrations of immunoglobulins and is free of pathogens. Contamination of colostrum by pathogens can be reduced by hygienic collection, pasteurization, storage, and handling of colostrum harvested from healthy cows.[9]

Immunoglobulin concentration can be affected by numerous factors, including parity and breed of the dam, the length of the dry period, farm vaccination program, disease history, and month of calving.[10] Colostrum quality can be estimated on farm with several different methods, including a colostrometer (measurement of specific gravity) and a Brix refractometer (measurement of sucrose). The percent of operations that estimated colostrum quality has steadily increased, with 53.3 percent of operations that hand-fed colostrum estimating colostrum quality in 2014, compared to 5.8 percent in 2002 and 13.0 percent in 2007. The most commonly used method in 2014 was visual appearance (45.1% of operations) (figure 5).

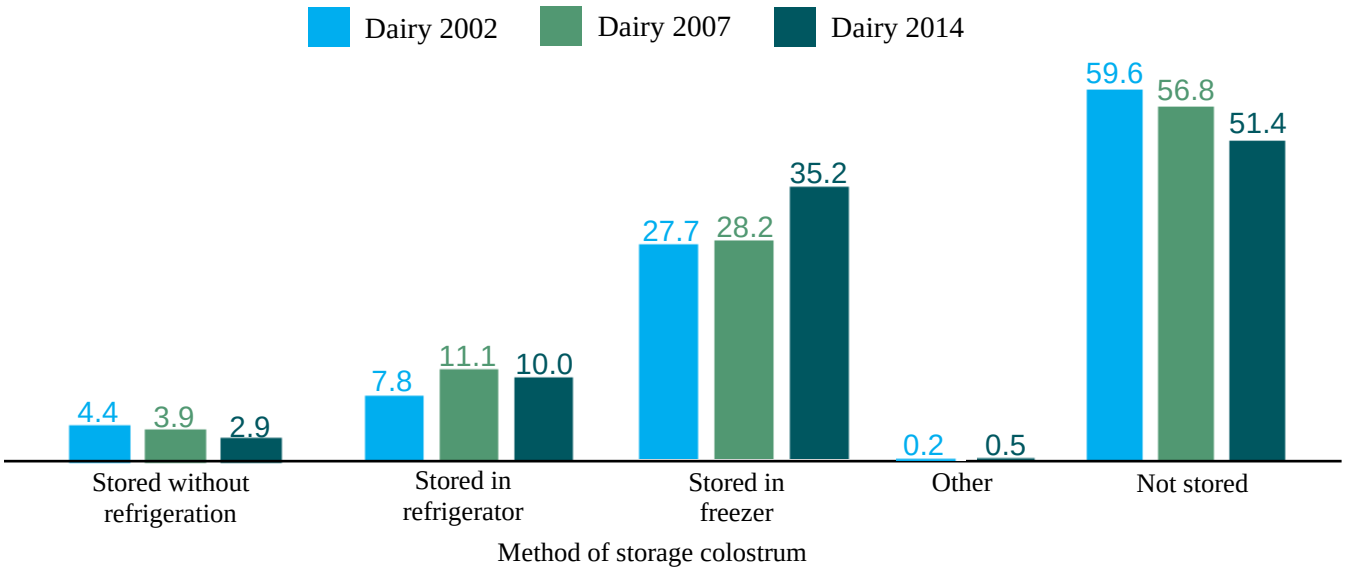
Figure 5. For operations that estimated immunoglobulin levels in colostrum or evaluated its quality, percentage of operations by primary method used for measuring immunoglobulins, 2014



COLOSTRUM STORAGE

Sanitary collection and storage of colostrum minimize bacterial contamination.[9] Storing colostrum is an important step to ensuring that all calves receive an adequate amount of colostrum soon after birth. The method used to store colostrum can impact the quality of the colostrum by either allowing bacterial growth to occur or by decreasing its storage life. More producers stored colostrum in 2014 compared to 2002 and 2007 (figure 7). The most common method of storing colostrum was freezing in all three years.

Figure 7. For operations that hand-fed colostrum, percentage of operations by primary method of storing colostrum



COLOSTRUM PASTEURIZATION

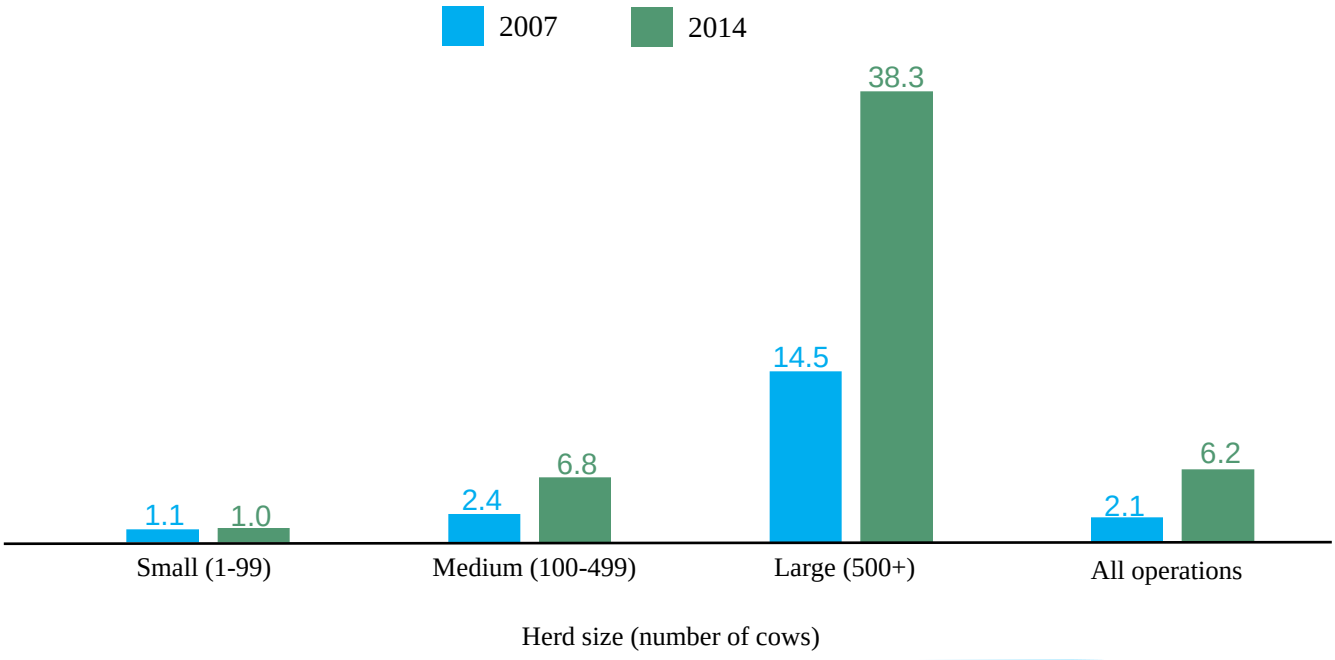
Pasteurizing colostrum, also known as heat treatment, helps reduce the overall pathogen load, as well as increase the absorption of IgG.[12] Two methods can be used for pasteurization: high temperature short time (HTST) and batch pasteurization. HTST pasteurization reduces the immunoglobulin levels by 25 to 30 percent, and increases viscosity; therefore, it is not recommended for use with colostrum. Using a batch pasteurization unit to heat the colostrum to 60 degrees Celsius for 60 to 120 minutes reduces bacterial pathogens and preserves the immunoglobulin concentrations in the colostrum.

In 2014, 5.5 percent of operations that handfed colostrum – representing 20.1 percent of calves – fed pasteurized colostrum. The percent of operations that fed pasteurized colostrum has increased over the years, with 0.6 percent of operations in 2002 and 0.8 percent in 2007. In 2014, a higher percentage of large operations (24.1 percent) pasteurized colostrum compared with medium and small operations (6.6 and 1.5 percent, respectively).

MONITORING PASSIVE IMMUNITY

Monitoring the success of a colostrum management program can be done by testing serum total protein in calves 1-7 days of age. Serum total protein can be measured on the farm using a refractometer. Less than 10 percent of all operations (6.2 percent) routinely monitored serum total protein to evaluate the colostrum management program in 2014 (figure 6). In 2014, a higher percentage of large operations (38.3 percent) routinely evaluated passive transfer compared with medium and small operations (6.8 and 1.0 percent, respectively).

Figure 6. Percentage of operations that routinely evaluated passive immunity in 2007 and 2014 by herd size (number of cows)



CONCLUSION

The most important factors for successful transfer of passive immunity include quality, quantity, timing, and cleanliness of colostrum. To improve passive immunity in dairy calves, operations should seek to follow current recommendations.

REFERENCES

1. Beam, A. L., Lombard, J. E., Kopral, C. A., Garber, L. P., Winter, A. L., Hicks, J. A., & Schlater, J. L. 2009. Prevalence of failure of passive transfer of immunity in newborn heifer calves and associated management practices on US dairy operations. *Journal of Dairy Science*, *92*(8), 3973-3980.
2. Robison, J. D., Stott, G. H., & DeNise, S. K. 1988. Effects of Passive Immunity on Growth and Survival in the Dairy Heifer 1, 2. *Journal of Dairy Science*, *71*(5), 1283-1287.
3. Wells, S. J., Dargatz, D. A., & Ott, S. L. 1996. Factors associated with mortality to 21 days of life in dairy heifers in the United States. *Preventive Veterinary Medicine*, *29*(1), 9-19.
4. Faber, S. N., Faber, N. E., McCauley, T. C., & Ax, R. L. 2005. Case study: effects of colostrum ingestion on lactational performance. *The Professional Animal Scientist*, *21*(5), 420-425.
5. DeNise, S. K., Robison, J. D., Stott, G. H., & Armstrong, D. V. 1989. Effects of passive immunity on subsequent production in

dairy heifers. *Journal of Dairy Science*, *72*(2), 552-554.
6. Weaver, D. M., Tyler, J. W., VanMetre, D.C., Hostetler, D.E., & Barrington, G. M. 2000. Passive transfer of colostral immunoglobulins in calves. *Journal of Veterinary Internal Medicine*, *14*(6), 569-577.
7. Nocek, J. E., Braund, D. G., & Warner, R. G. 1984. Influence of neonatal colostrum administration, immunoglobulin, and continued feeding of colostrum on calf gain, health, and serum protein. *Journal of Dairy Science*, *67*(2), 319-333.
8. Morrill, K. M., Conrad, E., Lago, A., Campbell, J., Quigley, J., & Tyler, H. 2012. Nationwide evaluation of quality and composition of colostrum on dairy farms in the United States. *Journal of Dairy Science*, *95*(7), 3997-4005.
9. Stewart, S., Godden, S., Bey, R., Rapnicki, P., Fetrow, J., Farnsworth, R., ... & Ferrouillet, C. 2005. Preventing bacterial contamination and proliferation during the harvest, storage, and feeding of fresh bovine colostrum. *Journal of Dairy Science*, *88*(7), 2571-2578.
10. McGuirk, S. M., & Collins, M. 2004. Managing the production, storage, and delivery of colostrum. *Veterinary Clinics of North America: Food Animal Practice*, *20*(3), 593-603.
11. Godden, S. 2008. Colostrum management for dairy calves. *Veterinary Clinics of North America: Food Animal Practice*, *24*(1), 19-39.
12. Johnson, J. L., Godden, S. M., Molitor, T., Ames, T., & Hagman, D. 2007. Effects of feeding heat-treated colostrum on passive transfer of immune and nutritional parameters in neonatal dairy calves. *Journal of Dairy Science*, *90*(11), 5189-5198.

The principal author of this information brief was Dr. Chelsey Shivley during her PhD program.

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