Colostrum Feeding and Management on U.S. Dairy Operations, 1991-2007

In 2007, the U.S. Department of Agriculture's (USDA) National Animal Health Monitoring System (NAHMS) conducted the Dairy 2007 study. In all, 17 of the Nation's major dairy States* representing 79.5 percent of U.S. dairy operations and 82.5 percent of U.S. dairy cows participated in the study.

Dairy 2007 is NAHMS fourth national study of the U.S. dairy industry. Previous studies were the 1991 National Dairy Heifer Evaluation Project (NDHEP), Dairy 1996, and Dairy 2002. As with the previous studies, Dairy 2007 surveyed dairy producers about their colostrum feeding and management practices. This information sheet provides comparisons of these practices from 1991 to 2007 across the four study periods.

Importance of colostrum

All animals need maternal immunoglobulins to protect them from disease, and most animals receive immunoglobulins in utero, across the placenta. Conversely, calves are born with no immunoglobulins and, therefore, have inadequate immunity at birth. To obtain immunoglobulins, calves rely on the ingestion of colostrum. The process by which the cow passes immunoglobulin to the calf via colostrum is called passive transfer of immunity. Studies have shown that failure of passive transfer increases calf morbidity and mortality, reduces calf growth rate and efficiency, and decreases first and second lactation milk production in heifers.

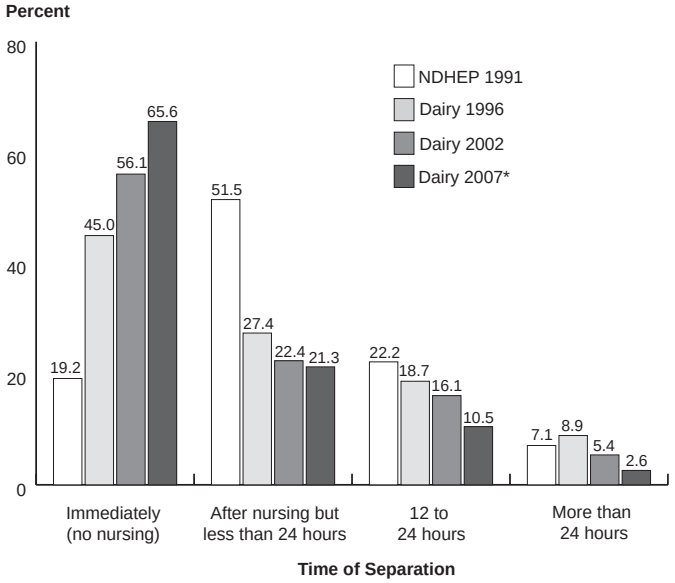
Separating calves from dams

Separating calves from their dams is one way to decrease the chance of disease transmission from cow to calf. For example, separation could prevent a calf from ingesting feces, bedding, or other material in the environment contaminated by a cow infected with *Mycobacterium avium* subspecies *paratuberculosis* (MAP), the causative agent of Johne's disease.

In 2007, 55.9 percent of operations—accounting for 65.6 percent of newborn heifer calves—immediately separated calves before they nursed their dams. Allowing a calf to acquire colostrum directly from its dam at first nursing presents many problems, such as increasing the risk that the calf will not get an adequate amount of colostrum. In addition, when a calf nurses from its dam it is not possible to accurately measure the amount of colostrum consumed; nor is it possible to estimate the quantity of antibodies ingested.

The practice of removing calves from their dams before nursing increased from 19.2 percent of heifer calves in 1991 to 65.6 percent in 2007 (figure 1).

Figure 1. Percentage of Heifer Calves by Time Following Birth that Calves were Normally Separated from Their Dams



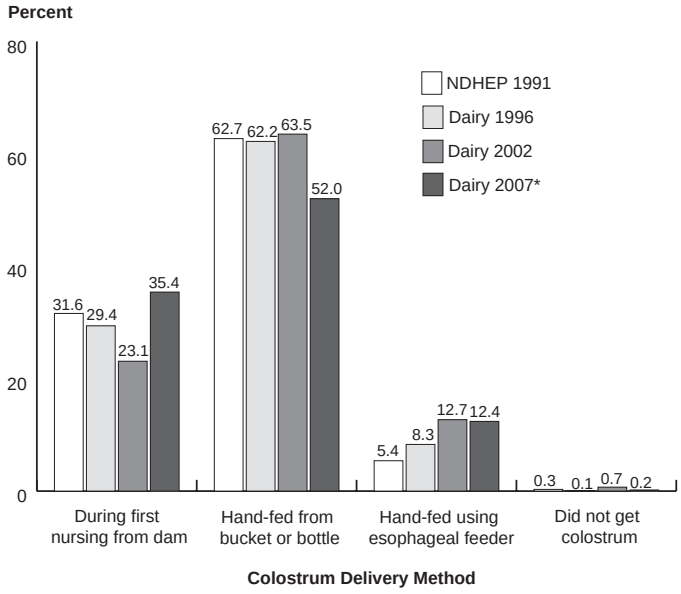
*For calves born during 2006 and alive at 48 hours

*California, Idaho, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New Mexico, New York, Ohio, Pennsylvania, Texas, Vermont, Virginia, Wisconsin, and Washington

Colostrum feeding

Hand-feeding colostrum increases the likelihood that calves receive the amount necessary to provide adequate immunity during the first 24 hours of life. The percentage of heifer calves that received hand-fed colostrum from a bucket or bottle remained essentially the same from 1991 to 2002 but decreased from 63.5 percent in 2002 to 52.0 percent in 2007. The percentage of heifer calves that received the first feeding of colostrum from their dams decreased steadily from 1991 to 2002 but increased from 2002 to 2007 (figure 2).

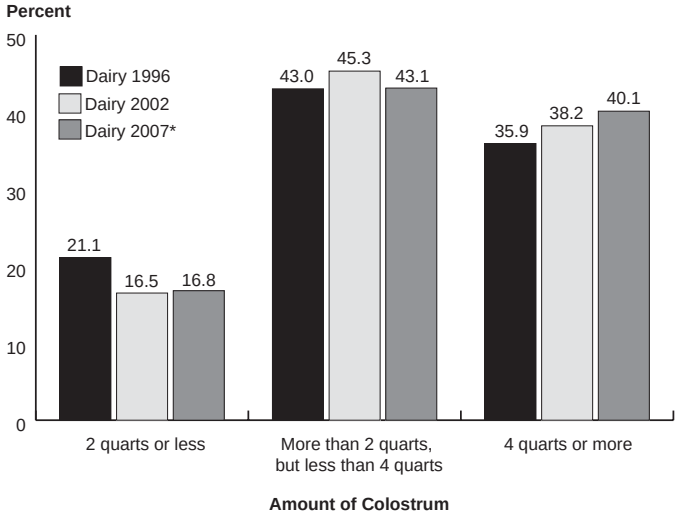
Figure 2. Percentage of Heifer Calves by Method Normally Used for Calves' First Feeding of Colostrum



*For calves born during 2006 and alive at 48 hours

In 2007, 45.8 percent of operations—accounting for 43.1 percent of heifer calves—hand-fed more than 2 quarts but less than 4 quarts of colostrum during the calves' first 24 hours of life. This trend of feeding almost half the heifer calves more than 2 quarts but less than 4 quarts of colostrum remained stable from 1996 to 2007 (figure 3).

Figure 3. For Heifers Calves on Operations that Normally Hand-fed Colostrum, Percentage of Heifer Calves by Amount of Colostrum Normally Fed During First 24 Hours



*Born during 2006 and alive at 48 hours

Colostrum quality

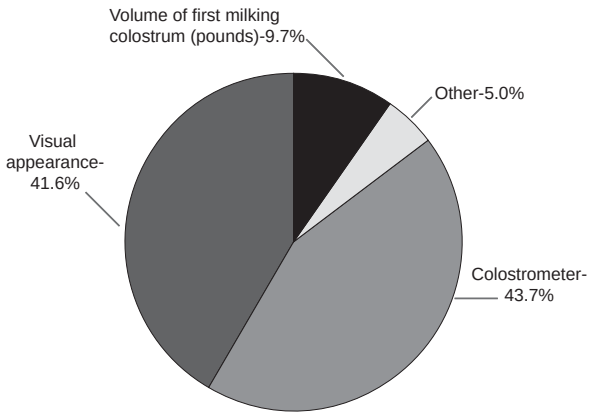
Although colostrum provides immunoglobulin and other immune factors to the calf, it can also be a route of disease transmission from cow to calf. As a result, colostrum quality plays a vital role in calf health. High-quality colostrum has adequate concentrations of immunoglobulin and is free of pathogens. Factors that determine immunoglobulin concentrations include the dam's age, disease history, pathogen exposure, prepartum milking, and leaking of milk from the udder prior to calving. Procedures that decrease the risk of pathogen contamination include hygienic collection, pasteurization, storage, and handling of colostrum harvested from nondiseased cows. Feeding poor-quality colostrum may result in decreased immunity in calves and, ultimately, increased infection.

Dairy producers can estimate the quality of colostrum by using a colostrometer, which uses specific gravity as a measure of immunoglobulin G (IgG) concentrations. Alternatively, serum from calves between 1 and 7 days of age can be evaluated for IgG level or total protein, which are used to measure the passive-transfer status of calves. IgG concentrations in blood of 1,000 mg/dl should be attained to provide adequate protection against failure of passive transfer.[1] The NDHEP 1991 study reported that over 40 percent of calves had IgG levels below 1,000 mg/dl or had failure of passive transfer.

In 2007, 13.0 percent of operations that hand-fed colostrum either estimated the immunoglobulin levels of colostrum or evaluated its quality before feeding, compared with 3.9 percent of operations in 2002. The most common methods used for evaluating colostrum quality in 2007 were a colostrometer and visual appearance (43.7 and 41.6 percent of operations, respectively) [figure 4].

Overall, 2.1 percent of operations routinely measured passive transfer via serum proteins. A higher percentage of large operations (14.5 percent) routinely evaluated passive transfer compared with medium and small operations (2.4 and 1.1 percent, respectively).

Figure 4. For Operations that Estimated Immunoglobulin Levels in Colostrum or Evaluated its Quality, Percentage of Operations by Primary Method Used for Measuring Immunoglobulin, 2007



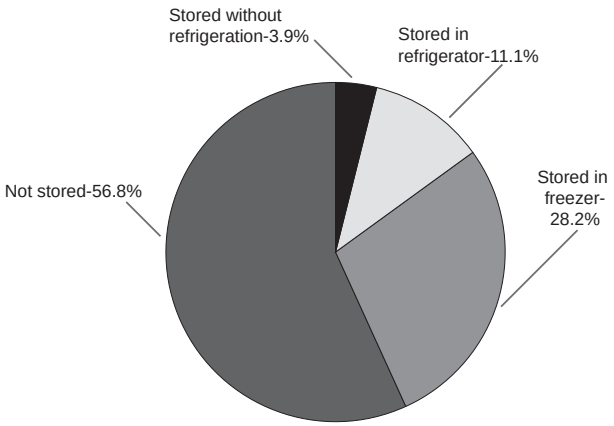
Pooling colostrum is not recommended because doing so may decrease colostrum quality and contribute to disease transmission. The percentage of operations that pooled colostrum decreased from 27.0 percent in 2002 to 21.0 percent in 2007.

Commercial colostrum replacer is an alternative to feeding calves colostrum from their dams. However, colostrum replacers vary greatly in their ability to provide adequate passive transfer. [2 3 4 5]

Colostrum storage

The method of colostrum storage also affects colostrum quality by either increasing bacterial growth in the colostrum or by shortening its storage life. Studies have demonstrated that refrigeration slows pathogen growth when colostrum is stored for 24 hours.[6] Moreover, refrigeration is recommended if colostrum is to be stored for less than 24 hours, and freezing is recommended if it is stored more than 24 hours.[7] The most common methods of storing colostrum in 2007 were freezing and refrigeration, although the majority of operations did not store colostrum (figure 5).

Figure 5. For Operations that Normally Hand-fed Colostrum, Percentage of Operations by Primary Method of Storing Colostrum, 2007



Colostrum pasteurization

Pasteurizing colostrum or milk reduces bacteria counts. In general, two methods can be used: high temperature-short time (HTST) and batch pasteurization. Since HTST pasteurization reduces immunoglobulin levels by 25 to 30 percent and increases viscosity, it is not currently recommended for use with colostrum. Alternatively, using a commercial batch pasteurization unit to heat colostrum to 60 degrees Celsius for 60 to 120 minutes reduces bacterial pathogens and does not reduce antibody concentrations or change overall viscocity.[8 9] In Dairy 2007, less than 1 percent of operations that hand-fed colostrum pasteurized the colostrum before feeding it to calves, which is similar to the percentage reported in the Dairy 2002 study (0.6 percent of operations). In 2007, a higher percentage of large operations (6.4 percent) pasteurized colostrum compared with medium and small operations (0.9 and 0.2 percent, respectively).*

Summary

Since 1991, the way colostrum is managed and fed to calves has changed on U.S. dairy operations. More operations are removing calves from their dams immediately after birth, which decreases the risk of direct disease transmission. Colostrum quality is being evaluated on a higher percentage of operations. Fewer operations are pooling colostrum, while more operations are pasteurizing colostrum. All these factors help to improve the quality of colostrum fed to calves. However, the quantity of colostrum administered to an individual calf on dairy operations has not changed since 1991. Dairy producers can improve their colostrum management practices by ensuring that every calf gets 4 quarts of high-quality colostrum during the first 12 hours of life.

*Herd size (number of dairy Cows)=
small (fewer than 100), medium (100-499), large (500 or more)

References

1 Gray, C.C. 1983. Failure of passive transfer of colostral immunoglobulins and neonatal disease in calves: a review. Proceedings, Veterinary Infectious Diseases Organization, 4th International Symposium on Neonatal Diarrhea, Saskatoon, SK, Canada.

2 Smith, G.W. and D.M. Foster. 2007. *Short Communication*: Absorption of protein and immunoglobulin G in calves fed a colostrum replacer. *J Dairy Sci*; 90(6):2905-2908.

3 Olson, J.D. 2007. New insights into managing the neonatal calf for health and production. http://ansci.colostate.edu/index2.php?option=com_content&task=view&id=381&pop=1&.

4 Swan, H., S. Godden, R. Bey, S. Wells, J. Fetrow, and H. Chester-Jones. 2007. Passive transfer of immunoglobulin G and preweaning health in holstein calves fed a commercial colostrum replacer. *J Dairy Sci*; 90(8):3857-3866.

5 Foster, D., G. Smith, T. Sanner, G. Busso. 2006. Serum IgG and total protein concentrations in dairy calves fed two colostrum replacement products. *JAVMA*; 229:1282-1285.

6 Stewart, S., S. Godden, R. Bey, P. Rapnicki, J. Fetrow, R. Farnsworth, M. Scanlon, Y. Arnold, L. Clow, K. Mueller, and C. Ferrouillet. 2005. Preventing bacterial contamination and proliferation during the harvest, storage, and feeding of fresh bovine colostrum. *J Dairy Sci*; 88(7):2571-2578.

7 USDA, APHIS, CEAH, BAHM. A guide to colostrum and colostrum management for dairy calves. 2001. http://www.aphis.usda.gov/vs/ceah/ncahs/nahms/dairy/bamn/BAMNGuide_to_Dairy_Feeding.pdf.

8 Godden, S., S. McMartin, J. Feirtag, J. Stabel, R. Bey, S. Goyal, L. Metzger, J. Fetrow, S. Wells, and H. Chester-Jones. 2006. Heat treatment of bovine colostrum. II: Effects of heating duration on pathogen viability and Immunoglobulin G. *J Dairy Sci*; 89(9): 3476-3483.

9 McMartin, S., S. Godden, L. Metzger, J. Feirtag, R. Bey, J. Stabel, S. Goyal, J. Fetrow, S. Wells, and H. Chester-Jones. 2006. Heat treatment of bovine colostrum. I: Effects of temperature on viscosity and Immunoglobulin G level. *J Dairy Sci*; 89(6): 2110-2118.

For more information, contact:

USDA:APHIS:VS:CEAH
NRRC Building B, M.S. 2E7
2150 Centre Avenue
Fort Collins, CO 80526-8117
970.494.7000
E-mail: NAHMS@aphis.usda.gov
http://nahms.aphis.usda.gov

#516.0308