Passive Transfer Status of Heifer Calves on U.S. Dairies, 1991–2007

The U.S. Department of Agriculture's (USDA) National Animal Health Monitoring System (NAHMS) conducted the Dairy 2007 study in 17 major dairy States.[1] One objective of the study was to describe dairy calf health and nutrition from birth to weaning and to evaluate heifer disease prevention practices. As part of this objective, blood was collected from newborn heifer calves to evaluate the transfer of maternal immunity (passive transfer) to calves.

NAHMS last measured passive transfer status on U.S. dairies in 1991–92 during the National Dairy Heifer Evaluation Project (NDHEP), which was conducted in 28 States.[2] This information sheet compares findings on passive transfer as reported in the NDHEP 1991–92 study and the Dairy 2007 study.

Importance of colostrum

Since maternal antibodies (immunoglobulins) do not cross the placenta, calves are born without adequate immunity. Calves receive these critical antibodies by ingesting and absorbing immunoglobulin-rich colostrum (predominantly immunoglobulin G [IgG]) from their dams, a process known as passive transfer of immunity. An example of the importance of colostrum to newborn calves can be found in the NDHEP study, which found that 22.0 percent of total calf deaths in 1991–92 might have been avoided if the animals had received adequate colostrum.

Four attributes of colostrum management that increase the probability that calves will acquire adequate levels of antibodies have been proposed:

1. **Quality—**Quality colostrum has an IgG concentration of at least 50 g/L.
2. **Quantity—**Calves should receive a minimum of 100 g of IgG and ideally 150 g. To account for variability in colostrum quality, a minimum of 4 quarts (3.8 L) of colostrum is recommended.
3. **Quickness—**Colostrum should be fed as soon as possible following birth as practical, preferably within 1 to 2 hours.
4. **Cleanliness—**Proper hygiene should be used when collecting and handling colostrum to decrease bacterial contamination, which may cause disease in calves. In addition, if colostrum is not fed within 1 to 2 hours of collection, it should be refrigerated or frozen.

Sample collection

For the NDHEP 1991–92 study, blood samples were collected from 2,177 heifer calves aged 24 to 48 hours to determine IgG concentration. For the Dairy 2007 study, blood samples were collected from 1,816 heifer calves aged 1 to 7 days to determine IgG concentration. For the NDHEP 1991–92 study, calves were sampled whether or not they had received colostrum. For the Dairy 2007 study, only healthy calves that had received colostrum were sampled.

Passive transfer estimates

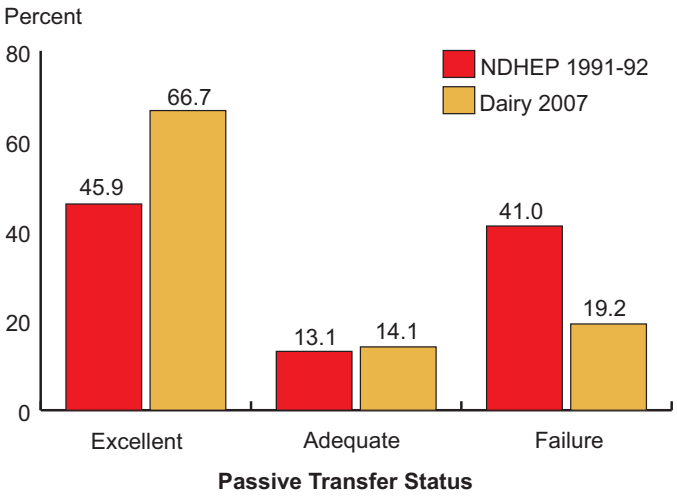
Although the level at which serum IgG provides adequate protection to calves varies by management situation (nutritional status, exposure to pathogens, etc.), a serum IgG concentration of 1,000 mg/dL is the minimum recommended. A calf's passive transfer status is excellent if its serum IgG level is 1,500 mg/dL or more and adequate if its serum IgG level is 1,000 to 1,499 mg/dL. A calf has failure of passive transfer if its serum IgG level is below 1,000 mg/dL.

In the NDHEP 1991–92 study, 45.9 percent of tested heifer calves had excellent passive transfer; 13.1 percent had adequate passive transfer; and 41.0 percent had failure of passive transfer. In the Dairy 2007 study, 66.7 percent of heifer calves had excellent passive transfer; 14.1 percent had adequate passive transfer; and 19.2 percent had failure of passive transfer (figure 1).

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

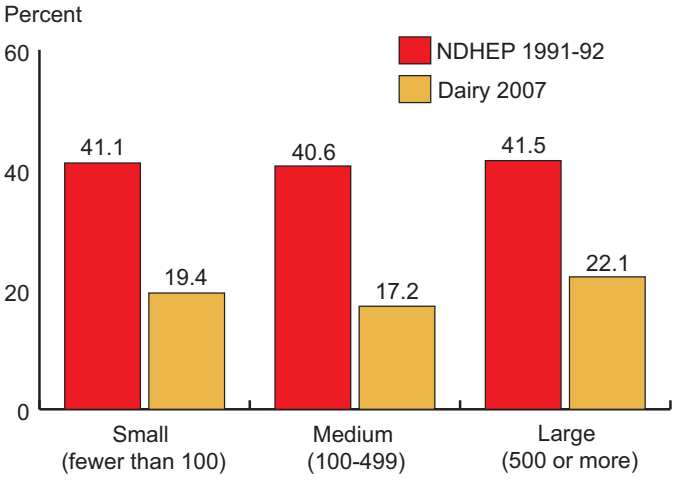
[2]Alabama, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, Washington, and Wisconsin.

Figure 1. Percentage of Heifer Calves by Passive Transfer Status



The percentage of heifer calves with failure of passive transfer decreased substantially across all herd sizes from 1991 to 2007 but did not vary by herd size within each study year (figure 2).

Figure 2. Percentage of Heifer Calves with Failure of Passive Transfer, by Herd Size



Effects of nursing on passive transfer

In 2007, heifer calves that were allowed to nurse their dams were more likely to have failure of passive transfer than calves not allowed to nurse (see table). There are several possible explanations for this finding. The quantity and quality of the colostrum suckled are unknown, and calves that suckle colostrum are likely to ingest less colostrum than the recommended 4 quarts at first feeding. Additionally, the ability of calves to absorb IgG decreases with time, and some calves do not nurse quickly enough.

Percentage of Heifer Calves with Failure of Passive Transfer in 2007, by Whether or not the Calves Nursed

Percent Calves	
No Nursing	**Nursed Dam**
16.9	25.8

Summary

The percentage of calves with failure of passive transfer decreased by about one-half from 1991 to 2007. Part of this decrease may be due to the fact that only healthy calves from 1 to 7 days old that had received colostrum were tested in the Dairy 2007 study, whereas calves between 24 and 48 hours of age and any health status—regardless of colostrum intake—were eligible to participate in the NDHEP 1991–92 study. Although the age of the calf at time of sampling was not associated with failure of passive transfer in 2007, the other differences in sampling between the studies could not be adjusted for. Overall, it appears that producers have improved passive transfer status in heifer calves.

Ensuring timely and adequate intake of high-quality colostrum is an important part of getting dairy heifer calves off to a good start. Although progress has been made in the last 15 years, about one of five calves still has failure of passive transfer. Producers can refer to educational materials[3] for assistance in improving colostrum management and the transfer of maternal immunity to calves.

[3] Alliance on Management and Nutrition. "A Guide to Colostrum and Colostrum Management for Dairy Calves." 2001.

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