Benchmarks for calf health before pair housing

Dairy cattle are a social species, and companionship is important for calves. Before deciding to move to pair or group housing, it is a good idea for a farm to take stock of the current health performance of their calves.

Individual housing of dairy calves has been the standard practice for over 5 decades. Identifying sick calves can be easier when they are housed separately. Individual housing can also limit calf-to-calf disease transmission when calves are separated from each other using solid panels or with physical distance between adjacent pens with wire panels.

However, calf disease is usually caused by a combination of factors, not just housing type. Raising healthy calves in pairs or groups is achievable when managed well. Nonetheless, when management of the various factors affecting calf health is not ideal, problems may emerge when pairing calves.

By measuring outcomes relating to calf health, producers can evaluate if the time is right for moving to pair or group housing on their farm. Regularly assessing calf health can also establish a baseline to help identify problems as they emerge.

Transfer of Passive Immunity

While in utero, calves cannot absorb the dam's protective antibodies through the placenta. Therefore, calves are born without inherent immunity to pathogens. Drinking maternal colostrum soon after birth (within 0 to 2 hours) is critical to help calves begin to establish their immune systems. This process, called the transfer of passive immunity, transfers the dam's immune factors to the calf before the calf begins to build its own immunity. Successful transfer of passive immunity reduces the risks for pre-weaning illness (morbidity) and death (mortality).

Testing for passive immunity allows us to directly assess whether the calf has absorbed sufficient immunoglobulins. The Dairy Calf and Heifer Association (DCHA) Gold Standards recommends sampling at least 12 calves to evaluate the status of passive immunity in your herd. Select calves at day 2 to 7 of life, ideally between 24 to 48 hours after birth. Be sure at least 24 hours have passed since calves were fed colostrum to ensure enough time for transfer to occur.

Follow the steps below. More details, including videos, are found in the Calf Health Module on The Dairyland Initiative website.

1. Collect at least 2-cc of blood from the calf's jugular vein using a red-topped blood tube.
2. Separate the blood into liquid (serum) and solids (red blood cells) by centrifuging the tube. Or, if you do not have a centrifuge, let the tube sit at room temperature overnight. First, use a fresh pipette, wooden applicator stick, or the wooden end of a swab to dislodge the initial blood clot from the wall of the tube.
3. Before testing samples each day, calibrate your refractometer using distilled water, following the manufacturer's instructions. Make sure the refractometer and the blood samples are at the same temperature.
4. After the sample separates, withdraw a portion of the yellow serum from the tube using a pipette or a needle and syringe. Take care to avoid disturbing the clotted cells. Place the serum on the glass of an optical or Brix refractometer, then lower the cover. For non-digital refractometers, look into the eyepiece to read the measurement.
5. Thoroughly wipe the sample well of the refractometer between samples. After testing the final sample of the day, clean the sample well of the refractometer with rubbing alcohol.

Recently, new guidelines have been published on the ideal proportion of calves within a herd falling into each of 4 categories of passive immunity transfer, ranging from poor to excellent (*Table 1*). When deciding whether to move to pair housing, aim for fewer than 10%, or even 5%, of calves in your herd falling into the "poor" category. The proportion of calves in the "good" and "excellent" categories should be at least as high as in *Table 1*.

If you are currently unable to achieve these targets, examine your newborn calf management and colostrum

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feeding protocols for areas of improvement. After making changes to your protocols, reassess passive immunity in a new sample of calves.

In a research study, dairy producers were given data on the status of their calves' passive immunity. Obtaining this information allowed the producers to identify how to make appropriate management changes, which resulted in significant improvements in passive immunity.

Table 1. *Categories of transfer of passive immunity and the desired percentage of calves in each category within a herd*

Category	IgG (g/L)[1]	STP (g/dL)[2]	Serum Brix (%)[3]	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

[1]Serum IgG concentration; [2]Serum total protein concentration, measured by refractometer; [3]Brix refractometer measurement. Table reproduced from Godden et al., 2019.

Mortality

In part thanks to widespread improvements to colostrum management practices, pre-weaned heifer calf mortality in the U.S. has dropped from nearly 11% to approximately 6% over the last couple of decades. However, there remains wide variation in calf mortality rates among dairy farms. Recent data from farms across multiple states found the highest death rates before weaning occurred in the first 3 weeks of life.

The DCHA Gold Standards suggests targeting a survival rate of at least 97% for calves between 24 hours to 60 days of age, which translates to a mortality rate of 3% or less. Note this excludes stillbirths, defined as deaths occurring less than 24 hours after birth. The formula to calculate mortality rate based on this definition is:

$$\frac{\text{calves dying between 24 hours to 60 days of age}}{\text{calves born per year} - \text{stillbirths}}$$

Although this goal sets a high bar, it is beneficial to start from an excellent baseline of calf survival rates before considering moving to pair or group housing

Morbidity

Approximately one third of dairy heifer calves across the U.S. experience pre-weaning morbidity, primarily from digestive and respiratory problems. This rate, in contrast with calf mortality, has unfortunately not decreased over the last couple of decades. For the best chance of success when transitioning from individual to pair or group housing, consistently low morbidity rates should be achieved first.

The DCHA Gold Standards currently suggests targeting morbidity rates of less than 10% for clinical pneumonia and less than 15% for scours requiring treatment during the pre-weaning period. Disease definitions and criteria for treating calves can vary, so work with your veterinarian on the best strategies for your farm.

A tool to help evaluate calves for illness in a consistent manner is the Wisconsin Calf Health Scoring system or the Wisconsin CalfScan system, available as a chart or as a digital application for Apple devices.

Lung ultrasound can confirm whether calves have respiratory disease, even when they are not showing visible symptoms. To identify the highest-risk age group for respiratory disease on your farm, your veterinarian can ultrasound 12 calves in each age group, starting at 7 days old and increasing in increments of 7 days of age until the age of onset is identified.

Weaning is a stressful period in a calf's life. Pair or group housing before weaning has been shown to improve calves' resilience to stress during weaning. Nonetheless, all calves experience many stressful changes during this time. The compounding of stressors can put calves at increased risk for respiratory disease during weaning. The #WeanClean™ Philosophy is to raise calves with healthy lungs to achieve good growth through the pre-weaning period and to reduce the need for antibiotics in the post-weaning period. At the beginning of weaning, when milk allowance is first reduced, the goal is for a herd to have fewer than 15% of calves diagnosed with pneumonia by ultrasound.

References

Atkinson, D.J., M.A.G. von Keyserlingk, & D.M. Weary. 2017. Benchmarking passive transfer of immunity and growth in dairy calves. J. Dairy Sci. 100:3773-3782.

Costa, J.H.C., M.A.G. von Keyserlingk, & D.M. Weary. 2016. Invited review: Effects of group housing of dairy calves on behavior, cognition, performance, and health. J. Dairy Sci. 99:2453-2467.

DCHA Gold Standards, 2nd Edition. 2016. Dairy Calf and Heifer Association.

Godden, S.M., J.E. Lombard, & A.R. Woolums. 2019. Colostrum management for dairy calves. Vet. Clin. Food Anim. 35:535-556.

Lombard, J., N. Urie, F. Garry, S. Godden, J. Quigley, T. Earleywine, S. McGuirk, D. Moore, M. Branan, M. Chamorro, G. Smith, C. Shivley, D. Catherman, D. Haines, A.J. Heinrichs, R. James, J. Mass, & K. Sterner. 2020. Consensus recommendations on calf- and herd-level passive immunity in dairy calves in the United States. J. Dairy Sci. 103:7611-7624.

McGuirk, S. & T.L. Ollivett. Calf Health Scorer Application (iOS). UW-Madison School of Veterinary Medicine. https://www.vetmed.wisc.edu/fapm/svm-dairy-apps/calf-health-scorer-chs/

Mills-Lloyd, S. & T. Kohlman. 2017. Heifer blueprint: Passive transfer. UW-Extension. https://fyi.extension.wisc.edu/heifermgmt/heifer-blueprints/

Ollivett, T.L. 2020. How does housing influence Bovine Respiratory Disease in dairy and veal calves? Vet. Clin. Food Anim. 36:385-398.

Ollivett, T.L. 2020. Calf Health Module – #WeanClean. The Dairyland Initiative. https://thedairylandinitiative.vetmed.wisc.edu/home/calf-health-module/

Urie, N.J., J.E. Lombard, C.B. Shivley, C.A. Kopral, A.E. Adams, T.J. Earleywine, J.D. Olson, & F.B. Garry. 2018. Preweaned heifers management on US dairy operations: Part V. Factors associated with morbidity and mortality in preweaned dairy heifer calves. J. Dairy Sci. 101:9229-9244.

USDA. 2018. Dairy 2014: Health and management practices on U.S. dairy operations, 2014. USDA-APHIS-VS-CEAH. Fort Collins, Co. https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy14/Dairy14_dr_PartIII.pdf

Wilm, J., J.H.C. Costa, H.W. Neave, D.M. Weary, & M.A.G. von Kesyerglink. 2018. Technical note: Serum total protein and immunoglobulin G concentrations in neonatal dairy calves over the first 10 days of age. J. Dairy Sci. 101:6430-6436.