

# The Newborn Calf & Colostrum Management

*Disclaimer: The following material presents general guidelines; each farm should develop their own Standard Operating Procedures.*

## Passive Immunity

Passive Immunity in cattle is the short-term immunity transfer from mother to offspring by way of colostrum consumption. This is very important in cattle because during pregnancy there is no transport of antibodies across the placenta. Therefore, calves are born with a naïve or immature immune system, basically they do not have an active immune system of their own and rely on colostrum which contains antibodies, technically called immunoglobulins (Ig), for priming the calf's immune system. In addition, it has a high content of fat to provide energy to the calf.

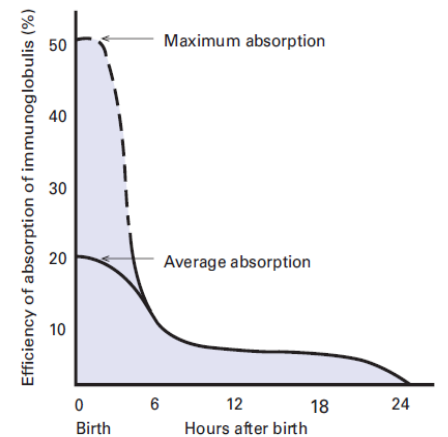
A newborn calf's small intestine is permeable or "open" and can absorb the immunoglobulins contained in colostrum. However, absorption of immunoglobulins through the intestinal wall into the blood stream starts to decline after the first 4 hours of life. For this reason, it is important that newborn calves receive colostrum as soon as possible, within 2-4 hours of hours of birth. The sooner the better! It is important to reduce the bacterial load to which newborn calves are exposed by keeping calving pens clean as they can also absorb environmental pathogens that can cause disease.

Failure to obtain and absorb immunoglobulins across the small intestinal wall into the blood stream will result in higher morbidity and mortality rates (illness and death). This is referred to as Failure of Passive Transfer (FPT). Calves with FPT are associated with decreased growth rates and increased health problems which represents a direct economic loss.

## Processing newborn calves

Processing newborn calves is an important job, and with an excellent system in place it is possible to prepare calves to have a healthy productive life. Common practices in successful calf management systems include:

- Dip the navel or umbilical cord in chlorohexidine solution or 7% iodine immediately after birth to disinfect and prevent bacteria from infecting the newborn.
- Move calves to a clean and dry environment immediately after birth to reduce the chances of environmental bacterial contamination.
- Vaccinations can be used to increase levels of specific antibodies and to boost the calves developing immune system; each farm should have a written and reviewed vaccination protocol to follow the first few weeks of life.



Source: Raising Dairy Replacements (1991).



## Harvest and Storage of Colostrum

Cleaning and prepping the cow's teats and udder will help to minimize the pathogen load in colostrum during the first milking. Remember that this cow has not been milked in about 60 days, so the pathogen load on the teat surface is greater than when she is in the milking barn. The cow's teats should be thoroughly cleaned using a disinfecting pre-dip solution like the one used on the lactating cows. The disinfecting solution must have a contact time of at least 30 seconds to effectively kill bacteria. The solution is then wiped off with a dry, clean towel or rag. The objective is to milk clean and dry teats!



Having sanitized milking equipment is also essential for collection of clean colostrum. The milking unit should be well cleaned and sanitized before and after milking the cow to avoid any cross-contamination to the next cow being milked.

It is important to know the immediate intent for colostrum. Will it be fed shortly after collection or will it be stored for future use? If not being fed shortly after collection, proper storage procedures should be taken to avoid further bacterial growth as the amount of bacteria present in colostrum can double in less than 20 minutes.

Colostrum may be refrigerated for no more than 24 hours because bacteria can still grow slowly at refrigerated temperatures. Colostrum can also be stored in a freezer. If freezing colostrum, it is recommended to put it in a gallon size zip-top bag and immediately place flat in a freezer. Bags are better than bottles because they allow for more even and quick thawing, which minimizes the presence of frozen chunks of colostrum. To thaw, place these bags in a water bath no warmer than 120 degrees Fahrenheit (49° C). Then bring colostrum to feeding temperature slowly; this temperature should be close to body temperature at about 102 degrees Fahrenheit (39° C). Do not try to shorten the thawing process by using water above the recommended temperature, doing so will destroy or inactivate some of the antibodies that a calf needs to survive. It is recommended to thaw only the necessary colostrum, repeated cycles of freezing and thawing may decrease the quality of the colostrum.



## Evaluation of colostrum quality

Colostrum is extremely important to promote a good start in a calf's life after birth. It is very important to invest time and resources to make sure that the colostrum fed to calves is of high quality. Colostrum quality depends on the content of immunoglobulins which are the proteins that convey protection against disease. There are laboratory tests to determine the exact amount of these proteins in colostrum; however, there are also approved on-farm methods to do the same. These methods are quick and practical.

*Visual Assessment: practical, but not very reliable*

This method is the easiest but the least reliable. Make sure colostrum is clean and free of manure. It should have a thick consistency; if colostrum has high content of proteins, it will be very thick. The thicker the better! Colostrum will have a yellow coloring; avoid feeding any colostrum that looks brown or has blood in it. Be mindful of mastitic milk as it can be watery or thick and undesirable for the calf to consume.

### *Colostrometer: practical, reliable, delicate instrument*

The colostrometer is a large thermometer-like glass instrument that measures the specific gravity of colostrum. It measures how thick a sample is, and this correlates to the immunoglobulin content of the colostrum. It is important to carry out the measurement when colostrum is at room temperature because cooler temperatures will cause the colostrum to thicken, resulting in an overestimation of its quality. When the instrument floats in the green zone area, it indicates high quality colostrum, medium quality is within the yellow area, very low quality is in the red area.

High Quality	Medium Quality	Low Quality
More than 50 g/L	Between 20 and 50 g/L	Less than 20 g/L



### *Brix Refractometer: practical and reliable*



The Brix refractometer is an instrument that measures sugar content in a variety of solutions and has been adapted to correlate this measurement with the content of immunoglobulins in colostrum. There is an

analog or manual model like the scope of a rifle and an electronic model with a digital screen that displays the result. It is common to see a lot a variation with the analog model because the scale may look blurry; it is recommended to use the electronic or digital version when possible because it allows more consistent readings. With either version, the reference value for high quality colostrum is 22% Brix or higher.



### **Information on Colostrum Replacer**

Colostrum replacers should be used when good quality colostrum collected from a cow is not available or when trying to eliminate contagious pathogens such as a disease called Johne's; never feed colostrum from cows identified as positive carriers of Johne's. Cows on the farm produce specific antibodies to infectious pathogens that they have encountered in their life and from their environment; therefore, when calves receive colostrum replacers, they will not receive the added benefits from the colostrum sourced from a cow on site. Good colostrum replacers have a high content of immunoglobulins per dose, which should be at least 150 grams of immunoglobulins. The amount of water used and the temperature of this water are very important in preparing colostrum replacer. Read and follow label instructions to deliver consistent and adequate amounts of colostrum replacer.

### **Recommended Colostrum Feeding Techniques**

Colostrum feeding programs must be designed for each specific farm according to their management practices. A rule of thumb is that calves should consume 10 to 15% of their birth weight as colostrum within the first 18 hours after birth. First feeding of colostrum should have at least 150 g of immunoglobulins to be considered high quality. Refer to monitoring tools above to accurately determine quality. Additional feedings of colostrum can be fed on days 2 and 3 of life, according to farm protocols. This colostrum can be of lesser quality or transition milk from the cow's second and third milking. This provides more nutrients to the calf and additional factors in long term health of the animal.

The appropriate temperature of colostrum and milk for calves is very important. Calves naturally prefer liquids that are close to body temperature at 102 degrees Fahrenheit (39° C). Colostrum or milk that is below this temperature may be less palatable, and calves may even refuse to drink. One of the consequences of feeding cold liquids is that internal temperature may drop and calves will use energy to generate heat to bring their temperature back up to normal instead of using energy for growth. It is important to consider the time delay between milk preparation and delivery to calves to avoid excessive cooling. Milk should be fed between 102 – 107 degrees Fahrenheit (39 to 41° C), above this range there is risk for burning of mouth and esophagus. Monitoring of temperature includes reading the temperature of the first and last bottles or bucket of milk delivered to the calves.

The most recommended method for colostrum feeding is using a clean bottle with a nipple, allowing the calf to nurse at its own pace. Calves should never be forced to drink from a bottle because the milk can get into the airways and cause aspiration pneumonia or even death. Never cause stress while feeding a calf, *it is very important to be patient with these young animals!* They are just learning how to suckle, and it may take a few minutes to coordinate this action. If a calf is having difficulty suckling it is then time to use an esophageal tube feeder. The esophageal tube feeder is not a tool or shortcut to speed up feeding of any calf!



*Using the Esophageal tube feeder to administer fluids to a calf*

First and foremost, seek out instruction and training on how to appropriately use an esophageal tube feeder. Each farm should have a Standard Operating Procedure for esophageal feeding. If the caretaker does not have proper training it is very likely that results will be poor and even fatal. Before using a tube feeder, there are 2 things that must be checked:

- The tube feeder must be clean: dirty equipment harbors bacteria that can infect the newborn
- The tube and mouthpiece must be free of any jagged edges: sharp edges may irritate the esophagus and they may also carry a high bacterial load

When introducing the esophageal tube, it is preferred to have the calf in a standing position, with its head and neck looking straight forward. Otherwise there is a greater risk of introducing liquid into the airways and cause aspiration pneumonia. Clamp off the flow of fluid before passing the tube along the side of the mouth, allowing the calf to swallow and then pass down the esophagus. The esophagus is the tube that transports feed and liquids to the stomach and lies above the trachea that carries air to the lungs. You may have to position the head of the calf downward to advance the tube past the epiglottis and into the esophagus. Once the tube is fully inserted, release the clamp and allow liquid to freely flow into the stomach.

After each use, clean, sanitize, and allow the esophageal tube feeder to dry. It is very common to use a tube feeder to provide electrolytes to sick calves so it very important to keep a separate esophageal tube feeder for colostrum and a separate one for electrolytes to minimize the risk of spreading diseases.

### **Evaluation of protein absorption from colostrum**

When a calf consumes colostrum, the immunoglobulins are absorbed through the intestinal wall into the bloodstream. This causes the protein content in blood to rise and this increase in blood protein can be measured to evaluate if a calf has received the necessary amount of antibodies to start a healthy life. If there are disease outbreaks or negative trends in mortality, it is recommended to review colostrum feeding protocols as well as



total serum protein to determine where the pitfalls may be. The procedure for measuring total serum protein requires a blood sample and a clinical refractometer (it is not the same as the Brix refractometer). This instrument is available in both analog and electronic versions. The blood sample must be drawn at 18 hours after birth at the earliest and 7 days at the latest to ensure that there has been enough time for the proteins to be absorbed. After collecting the sample, the vial must stay upright for 24 hours or overnight for the serum to separate. The serum is the semi-crystalline yellowish liquid that rises to the top of the blood tube. Place a couple of serum drops on the glass of the refractometer and read by looking through the eyepiece. The minimum value for successful passive transfer is 5.5 mg/dL.

There have been some recent reports of the possibility of using a Brix refractometer to assess passive transfer. The procedure is identical as previously described but the reference values are yet to be unified, acceptable readings fall between 7.8 and 8.4% Brix.

If serum protein levels fall below acceptable values for successful passive transfer, it is important to review possible causes and ways to correct or prevent failure of passive transfer.

Issue	Solution
<p><b>Delayed colostrum feeding</b>  <b>Amount of colostrum consumed was not enough/Low absorption of colostrum antibodies</b></p>	<p>Make sure calves consume first feeding colostrum within 2 to 4 hours after birth            Feed highest quality colostrum for their first 2 meals. Calves should consume at least 10 to 15% of their birth weight during their first 18 hours of life. If needed, use an esophageal feeder.</p>
<p><b>Low quality colostrum</b></p>	<p>Use tools such as colostrometer or Brix refractometer to determine colostrum quality and only feed high quality colostrum to newborn calves. Feed a minimum of 150 g of IgG within 2 to 4 hours after birth. Consider colostrum replacer if needed.</p>

*In review, providing these steps will prepare calves to have a healthy, productive life:*

- *Quality: >50g/L IgG, recommended at least 150 grams of IgG at 1<sup>st</sup> feeding*
- *Quantity: 10-15% of bodyweight within first 18 hours of life*
- *Quickness: First feeding as soon as possible within 2 to 4 hours*
- *Clean: make sure all equipment for harvest, storage, and delivery are sanitized for each calf*
- *Measure quality of colostrum using a colostrometer or Brix refractometer*

### Acknowledgements

Authored by Jennifer Bentley, Iowa State University Extension and Outreach, Dairy Field Specialist; Ryan Breuer, Iowa State University College of Veterinary Medicine, Veterinary Clinical Sciences – Food Animal Medicine Resident; Ezequias Castillo Lopez, University of Mexico, Professor; Kim Clark, University of Nebraska-Lincoln, Dairy Extension Educator; Paul Kononoff, University of Nebraska-Lincoln, Associate Professor of Dairy Nutrition/Dairy Extension Specialist; Hugo Ramirez Ramirez, Iowa State University, Assistant Professor Dairy Nutrition and Management

Funding for this project was provided by the North Central Risk Management Education Center, the USDA National Institute of Food and Agriculture under Award Number 2015-49200-24226.

*Iowa State University Extension and Outreach programs are available to all without regard to race, color, age, religion, national origin, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to Office of Equal Opportunity, 3350 Beardshear Hall, Ames, Iowa 50011, (515) 294-7612.*

*UNL does not discriminate on the basis of race, ethnicity, color, national origin, sex (including pregnancy), religion, age, disability, sexual orientation, gender identity, genetic information, veteran status, marital status, and/or political affiliation in its programs, activities and employment. UNL complies with all local, state and federal laws prohibiting discrimination, including Title IX, which prohibits discrimination on the basis of sex. For more information visit [go.unl.edu/nondiscrimination](http://go.unl.edu/nondiscrimination).*