Calf 101 – An Introduction to Calf Nutrition and Management

Transcript Unit 01, Section 4

64. Hello and welcome to Section 4 of Unit 1, Colostrum Management. In this section, we'll talk about the management of colostrum. Specific topics include contamination and storage, pasteurization, and some miscellaneous considerations. Let's have a look.

65. It's hard to overstate the importance of cleanliness of colostrum. It's a critical factor affecting the health of the calf. Research indicates that much of the colostrum fed to calves contains large numbers of bacteria. Contaminated colostrum reduces the apparent efficiency of absorption and may cause diseases such as Johne's disease, salmonellosis, and others.

66. Unfortunately, colostrum contamination is very common. Whether the colostrum is fed raw, stored improperly, or stored in large containers in the refrigerator or freezer, it's very common to see contaminated colostrum.

67. Here is a hypothetical example of how colostrum may become contaminated quickly when left at room temperature too long. This is a sample of colostrum that contains 10,000 colony-forming units of bacteria per milliliter (cfu/ml). This is quite clean, actually, as some on-farm samples can have 100,000 or more cfu/ml due to incomplete cleaning of milking equipment. Let's assume that bacteria in colostrum double about every 20 minutes, which is a common statistic used in the dairy processing industry. At 20 minutes, the colostrum count increases to 20,000, then 40,000 cfu/ml. By the end of 2 hours, we have a bottle of colostrum that contains more than 1 million bacteria per milliliter, which is no longer fit to feed to a newborn calf.

68. These two graphs show the same type of bacterial growth, but on two different scales. The graph on the left shows a normal scale, and the one on the right shows a logarithmic scale. Doubling bacterial populations is a logarithmic event, which is why the line is straight. This is really the best way to express bacterial growth.

69. Here is a YouTube video that shows how bacteria reproduce. The process is called binary fission. The bacterium replicates its own DNA and divides into two genetically identical daughter cells. The process continues as long as there are resources in the environment for the bacteria to replicate. **{Video}**

70. To make the point that colostrum is easily contaminated, I'll show you a study published in 2005 by Stuart et al. In this research, samples of colostrum were collected into clean equipment and stored in a farm refrigerator at 4°C or at room temperature for 24, 48, or 96 hours. Total plate counts were measured to determine the rate of contamination. The graph shows total plate counts in thousands of CFU per milliliter in either refrigerated or room temperature samples at 0, 24, 48, and 96 hours. When the samples were first collected, they both contained 100,000 cfu/ml. Remember, this is the maximum concentration we like to see in colostrum to be fed to calves. By 24 hours, the refrigerated samples contained over 500,000 cfu/ml, and by 48

hours they were over 4,000,000 cfu/ml. By 96 hours, the concentrations had declined to about 1.5 million, probably as a result of fermentation and acid production.

The blue bars show what happened when the samples were at room temperature. By 24 hours, bacterial counts increased to over 18 million cfu/ml—so high that they couldn't be displayed on the graph. By 48 hours, the concentration had declined again to about 4 million cfu/ml, likely due to acid production during fermentation killing off some bacteria. If our goal is to maintain 100,000 cfu/ml or less, we can clearly see that either refrigerating for extended periods or leaving colostrum at room temperature is not effective. This research is the basis for the recommendation that colostrum should not be stored in the refrigerator for more than 24 hours.

71. In another study, samples of colostrum were collected from dairy farms across the U.S. and evaluated for total plate counts. Samples were taken fresh from the cow, immediately after collection, as well as from the refrigerator and freezer. Total plate count categories were defined as follows: blue for less than 100,000 cfu/ml (optimal), yellow for 100,000 to 500,000, orange for 500,000 to 1 million, and red for more than 1 million cfu/ml.

    For the fresh samples, over two-thirds were in the optimal category, and only about 12% contained more than 1 million cfu/ml. While not ideal, this is still better than other options. Frozen samples showed about 61% in the optimal category, but roughly 40% contained too many bacteria. The worst case was refrigerated samples—only 23% were in the optimal category, and 38% contained 1 million cfu/ml or more. Clearly, storing colostrum in the refrigerator is a significant problem on many dairy farms.

72. One way to improve the microbiological quality of colostrum is through pasteurization. Pasteurizing colostrum has been evaluated in many studies over the last 10 to 15 years. Researchers have examined the effects of time and temperature on colostral IgG, viscosity, and efficiency of absorption. The data are clear—when colostrum is properly pasteurized, IgG absorption and efficiency of absorption are generally improved.

    Pasteurization conditions for colostrum differ from those for whole milk. Colostrum should be pasteurized at 60°C for 60 minutes to reduce pathogen load effectively. Remember, pasteurization is not sterilization, and if pasteurized colostrum is mishandled, bacteria can regrow to pre-pasteurization levels. We generally recommend collecting colostrum, testing it with a Brix refractometer, pasteurizing high-quality colostrum, and then feeding it immediately or storing it in the freezer. Lower-quality colostrum can be used as transition milk.

73. Pasteurizing colostrum is different from pasteurizing milk. Batch pasteurization is the most common method. The temperature is increased to 60°C and held there for 60 minutes—no more, no less. If you fall outside these limits, you either won't achieve adequate microbial reduction or you risk damaging the proteins and making the colostrum unusable. It's essential to do this correctly, which is why more producers are using commercial machines that provide precise control.

74. There are a number of colostrum preservatives available. A commonly used product is potassium sorbate, added at about 0.5%. However, sorbate works best when combined with refrigeration, so it is not a substitute for proper storage practices.
75. One question often asked is whether it's better to feed colostrum by nipple bottle or esophageal feeder. Research shows that differences in IgG absorption or efficiency of absorption are minimal. The advantage of an esophageal feeder is that it allows delivery of larger volumes. However, it requires training, more maintenance, and is harder to clean than a nipple bottle.
76. Here are a couple of studies comparing tube versus bottle feeding. In the first study by Godden, calves were fed either 1.5 or 3 liters of colostrum by bottle or tube. When 1.5 liters was fed, AEA was reduced from 51% to 41% with tube feeding. However, at 3 liters, there was no difference. In a second study, calves were fed 3.8 liters either by nipple or tube, and neither IgG nor AEA were affected.
77. In general, most data suggest there may be a small reduction in AEA with tube feeding because colostrum enters the rumen before moving to the abomasum. However, this effect appears to be minor.
78. There's a lot of interest in leaving calves with the dam to nurse during the first 24 hours after birth. The research here is very clear. Calves that nurse the dam consume less colostrum and begin nursing later than calves that are bottle-fed. The serum IgG concentrations they achieve are almost always lower. Disease incidence and mortality are higher. The graph shows that in some cases, more than 40% of calves did not nurse within the first eight hours after birth. Given the importance of early colostrum intake, this delay is a serious problem.
79. When calves are left with the dam, rates of failure of passive transfer (FPT)—defined as serum IgG less than 10 g/L—are much higher than when calves are hand-fed. In some studies, FPT exceeds 60%. This is unacceptable and significantly increases morbidity and mortality. This is an animal welfare concern.
80. One alternative is to allow the calf to remain with the dam but ensure it receives colostrum by hand feeding. In an Italian study, calves were allowed to nurse, were supplemented with 3 liters of colostrum, or were only hand-fed without nursing. The rate of FPT ranged from 11% to 60% and was lowest when calves received supplemental feeding. This may be a viable option where calves must remain with the dam for the first 24 hours.
81. Farmers are very ingenious when it comes to colostrum storage, using nipple bottles, gallon jugs, or large containers. However, large containers are generally a poor choice because they freeze slowly, allowing bacterial growth. Specialized containers like the Perfect Udder bag or ColoQuick system are excellent alternatives, and I highly recommend them.
82. Thawing colostrum can be done in warm water or a microwave, but microwave thawing is often more trouble than it's worth. Specialized systems like Dairy Tech or ColoQuick

can warm frozen colostrum in about 30 minutes and are becoming more popular. If thawing in buckets or a sink, maintain water temperature below 50°C (about 120°F) to avoid damaging proteins.

83. Let's stop for a moment of reflection. Colostrum management is so important to calf health that it must be taken seriously. Written protocols are recommended, and records should be kept. It's important to understand variability in colostrum quality and how that affects serum IgG levels in calves. Do producers know how many calves meet current recommendations? How well are feeding and storage managed? What weak points exist in the system? These are all important questions when building a colostrum program.
84. To summarize, colostrum should contain less than 100,000 cfu/ml of total bacteria and less than 10,000 cfu/ml of coliforms. Pasteurization is valuable. Feeding by tube or bottle as soon as possible after birth is best. Nursing alone is not recommended. If a calf must remain with the dam, intervention is needed to ensure it receives at least 3 liters of colostrum as soon as possible.
85. Here are a few additional resources on colostrum feeding that can provide valuable information to further your understanding of colostrum management.
86. Well, congratulations—you've completed Unit 1. You're well on your way to becoming an expert in calf nutrition and management. I look forward to seeing you in Unit 2, where we'll discuss whole milk management. See you then.