

Calf Notes.com

Calf Note 163 – Bacteria in colostrum – how are we doing?

Introduction

The key requirements for managing and feeding colostrum can be boiled down to four components – “ENOUGH colostrum that is CLEAN and STRONG and fed FAST”. ENOUGH colostrum means you need to feed a sufficient volume colostrum to give the calf enough IgG and other immune components; FAST means you need to feed the colostrum within an hour of two of birth; CLEAN means the colostrum cannot be contaminated with potentially infective pathogens; and STRONG means the colostrum must contain a sufficient amount of IgG, immune components and nutrients.

So, how are we doing? This Calf Note will review the results of two studies presented at the 2011 National ADSA scientific meetings in July, 2011 that addressed the question of microbial contamination in colostrum. Each study suggests that we can and need to do much better in caring for our colostrum microbial quality.

A Nationwide study

The first study was conducted by researchers at Iowa State University (Conrad et al., 2011). This group traveled to 12 different states in the U.S. to visit 67 different dairy farms. Samples of colostrum (first milking only) were collected from different breeds, lactations and methods of storage (refrigerators, freezers, or buckets just after milking) and from pooled or non-pooled samples. Only colostrum available at the time the researchers visited the farm were collected. They then surveyed farm personnel to better understand how the colostrum was managed from collection to feeding. Samples were subsequently analyzed for total bacteria plate count as an index of contamination. Total plate count is measured by placing a sample of colostrum onto a growth plate and allowing bacteria to grow measurable colonies, which are then counted. The results, called colony forming units, or cfu per milliliter of colostrum are an index of the bacteria in the colostrum sample.

A total of 892 colostrum samples were collected and analyzed. Samples were from Holsteins (n = 629), Jerseys (n = 191) and unidentified (n = 102) breeds. The average plate count was 5.50×10^5 cfu/ml (550,000 cfu/ml), which was well above the recommended industry standard of $<1.0 \times 10^5$ cfu/ml (100,000 cfu/ml). Colostrum that exceeded 100,000, 500,000 or 1,000,000 cfu/ml accounted for 46%, 27%, and 17% of samples, respectively. Many samples were highly contaminated – in the study, 148 of the 892 samples contained more than 1,000,000 cfu/ml, indicating that bacterial contamination of colostrum is a significant problem.

Where are all the bacteria coming from? One source of contamination is from dirty equipment. In a Journal of Dairy Science article (available in PDF format [here](#)), Stewart et al. (2005) reported that colostrum was clean when collected directly from the cow, but became highly contaminated during handling and storage.

In the present study, colostrum was transferred from one container to another average of 2.5 times before feeding. Some colostrum (about 9% of all samples) was transferred up to four times before feeding. Of course, each time colostrum is transferred to a new container, there's a risk of that container to be dirty and increase bacterial contamination.

The other major source of bacterial contamination is from storage at temperatures that allow bacteria to grow. At warm temperatures, bacteria reproduce very rapidly. It's been reported that bacteria can double about every 20 minutes in warm colostrum. Thus, keeping colostrum cold or feeding it immediately is very important to minimize risk of bacterial contamination.

Conrad and co-workers reported that the average time from collection to feeding or storage was 48 minutes, with 54.3% of samples being fed or stored >60 minutes after collection. Let's look at the implications here. Let's assume that the colostrum has an initial concentration in the bucket (after collection) of 100,000 cfu/ml (similar to the data of Stewart). We then allow it to sit at temperature for 60 minutes. This would allow the bacteria to reproduce about three times (every 20 minutes). So, at the end of the hour, bacteria count increases from 100,000 to 800,000 cfu/ml. This clearly is a problem and likely contributed greatly to the high rates of bacterial contamination observed in the study.

The researchers also reported that colostrum was allowed to sit at room temperature for an average of 33 minutes after being removed from storage (refrigerator or freezer) before feeding, with 20% of samples sitting out for >60 min before being fed. These survey results indicate that MC management practices may be responsible for the high levels of bacterial contamination observed in their research.

These data suggest that in the context of the four goals for colostrum feeding – ENOUGH, FAST, CLEAN and STRONG – the issue of CLEAN colostrum is one that still requires considerable attention.

A California survey over time

The second study by Zhelev et al. (2011), researchers at Fresno State University visited seven dairies in the Central Valley of California and collected colostrum samples for analysis of quality and bacterial contamination. The dairies ranging in herd size from 800 to 4000 adult cows. Colostrum samples (n = 546) were collected before first colostrum administration to newborn Holstein heifers. Three of the 7 dairies added a colostrum supplement to colostrum (n = 312). On these dairies, 2 colostrum samples were obtained, one before adding supplement and one after supplementation. Colostrum collection began July 2009 and continued monthly through June 2010.

Colostrum contained bacterial counts ranging from 13,420 to 2,171,835 cfu/ml. A total of 18% of unsupplemented colostrum samples contained >100,000 cfu/ml. Supplemented colostrum was contaminated in 57% of cases. Thus, 40% of the 546 calves were fed contaminated colostrum. A dramatic increase in SPC (52,817 to 2,171,835 cfu/ml) in supplemented compared with unsupplemented colostrum was observed in one dairy. It is possible that colostrum + supplement were mixed in dirty containers, or, alternatively, the colostrum supplement contained a microbial additive. Unfortunately, samples and ingredients in supplements were not determined in the study.

There was significant variation in the results, with four dairies consistently producing colostrum below the contamination threshold of 100,000 cfu/ml. The other dairies struggled and were responsible for most samples of contaminated colostrum. The four well managed dairies typically had well designed protocols for collecting, handling and storing colostrum. These protocols were usually followed closely and resulted in higher quality colostrum.

Summary

These two surveys clearly indicate the need for dairy producers to improve colostrum handling. While pasteurization is a viable method for improving microbial quality of colostrum (see [Calf Note #96](#) for more information), it's also important for producers to understand that colostrum is a highly perishable commodity and proper collection and handling protocols are necessary.

Producers should take some time to develop written colostrum handling protocols – particularly in relation to how it is collected and how and when it should be refrigerated or frozen.

References (NOTE: hyperlinks are available to each reference).

[Conrad](#), E., K. Morrill, J. Quigley, and H. Tyler. 2011. Management factors affecting microbial contamination of bovine colostrum. *J. Dairy Sci.* 94(E-Suppl.):355.

[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.* 88:2571–2578.

[Zhelev](#), I. Z., N. D. Spiro, J. D. Robison, J. Quigley, and A. Lago. Immunoglobulin G1 concentration and bacterial contamination of colostrum fed to newborn Holstein heifers in central California dairies. *J. Dairy Sci.* 94(E-Suppl.):353.

Written by Dr. Jim Quigley (27 December 2011)
© 2011 by Dr. Jim Quigley
Calf Notes.com (<http://www.calfnotes.com>)