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Calf Note 195 – What goes around comes around…

Introduction

Have you ever heard the old saying "What goes around comes around"? In this case, I'm NOT referring to the music video by Justin Timberlake (which you can find on YouTube) … but the saying that old things become new again. Or, perhaps, we have to relearn old things learned long ago.

Recently, I was reviewing publications from the Journal of Dairy Science (FYI, old issues are available at www.journalofdairyscience.org) for research studies related to calves. The Journal has digitized their entire catalog, so every article from Volume #1, written back in 1917 is available online (Note: this year, the Journal is publishing Volume 100). Incredible. The amount of information contained therein is simply staggering with the volume of high quality science literally available at our fingertips. What a resource!

I performed a search of the Journal archives for the word "colostrum" and accidentally sorted the available articles by date – inadvertently by earliest data first (FYI, there were 3,648 articles containing the word "colostrum" in the Journal archives as of this writing!). An article that immediately caught my eye was entitled "**The Colostrum Problem and Its Solution**" by Ragsdale and Brody (two famous names in animal nutrition research) from the University of Missouri, in Columbia, Missouri. The article (available here) was published in 1923, in Volume 6 of the Journal.

Keep in mind that back in 1923, the technology available to conduct research was undeveloped. There were no immune assays, limited methods for identifying proteins, and no on-farm methods for determine quality of colostrum. The refractometer was invented in the late 1800's but application on farm would require nearly 100 years of further refinement. Therefore, many of the conclusions made by researchers were due to careful observation, astute understanding of animal physiology (within the limits of knowledge at the time) and insightful interpretation of the data. Of course, there were many dead-ends and misinterpretations, but in general, the scientific method eventually brought us to the understanding of animal nutrition, immunity and physiology that we have today.

The article by Ragsdale and Brody is worth a read, if only for a perspective of how far we've come since 1923. Or… how we sometimes must relearn what has been already learned. To that point, I will comment on the summary from the end of the article. In italics below are the verbatim statements in the summary with my commentary:

The blood of the newly born calf contains no globulin or immune bodies. Colostrum is very rich in globulin and immune bodies. The globulin and immune bodies in colostrum pass into the blood of the newly born calf unchanged in the alimentary canal. These facts, and the further facts that disease and death rate is much higher among animals which do not receive colostrum than it is among those which do receive colostrum indicates that it is essential for newly born calves to get colostrum.

The importance of colostrum was recognized more than 100 years ago; indeed, many good farmers knew intuitively that the first "mother's milk" from the cow was essential for health and growth of the calf. However, this is one of the first documented statements in a scientific journal to the fact that intact components (which we now understand as immunoglobulins) in colostrum are absorbed into the

bloodstream of the calf and confer passive immunity. The article states that when calves were properly fed colostrum, neonatal mortality was <10% whereas when colostrum was not fed, it was >25%.

In 1923, researchers didn't understand that "immune bodies" and "globulin" were one in the same. Today, we know that the cow produces colostrum with large amounts of immunoglobulins – IgG, IgA and IgM – to provide immunity to the newborn calf. And, as far as recommending that newborn calves should be fed colostrum – perhaps this is one of the first scientific recommendations?

If the colostrum is infected with pathogenic organisms, these organisms may be inactivated by pasteurization. Pasteurization does not change the properties of colostrum to any appreciable extent provided the pasteurization is done in a water bath thereby avoiding local hot zones. On account of the relatively rapid rise of the temperature coefficient of heat-coagulation of proteins with rise of temperature, the lower pasteurization temperatures offer a wider margin of safety than the higher pasteurization temperatures; 140°F, is the safest temperature for pasteurizing colostrum.

A quick review of the history of pasteurization indicates that recommendations to pasteurize milk began in the late 1800's. Thus, this may be the first recorded evaluation of pasteurization of colostrum, the effects on colostrum quality and recommended temperatures. Today, we routinely recommend that colostrum should be pasteurize at 140°F (60°C) for 60 minutes to be sure to reduce the numbers of *Mycobacterium avium* paratuberculosis (Johne's disease).

Early attempts to pasteurize products often used direct flame or steam injected into the liquid to increase the temperature. In the case of milk or colostrum, these procedures would cause proteins to coagulate, thereby rendering the colostrum ineffective. The use of a water bath was recommended in this article to eliminate these problems.

Pasteurizing colostrum at 140°F. for twenty to thirty minutes does not appreciably change the properties of colostrum and experience shows that calves fed on such pasteurized colostrum get along in every respect as well as calves that are naturally fed, and very much better than calves which received no colostrum.

Our recommendation today is to extend pasteurization of colostrum to 60 minutes, but at the same temperature. Though most pathogens are eliminated after 30 minutes of pasteurization, a longer time period has been shown to reduce a greater variety of pathogens. How many studies have been done in the last 20 years to show similar results to this study?

The satisfactory method to raise a calf from a cow infected with tuberculosis is therefore to separate the calf from its mother at birth, and feed the calf its mother's pasteurized colostrum during the first two to three days after birth. The colostrum should be pasteurized in a water bath at 145°F. for twenty minutes, or preferably at 140°F. for thirty minutes.

Sage advice, whether the infirmity is tuberculosis, paratuberculosis, E. coli, or other pathogens.

The old saying, attributed to Winston Churchill (and others) comes to mind: "Those that fail to learn from history, are doomed to repeat it."

Reference

Ragsdale, A. C. and S. Brody. 1923. The colostrum problem and its solution. J. Dairy Sci. 6:137–144.

Written by Dr. Jim Quigley (12 August 2017)

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