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Calf Note 196 – Feeding waste milk. What's the risk?

Introduction

Waste milk – including colostrum, transition milk and antibiotic-treated milk – is commonly fed to calves as a source of nutrition prior to weaning. According to the USDA NAHMS Dairy 2014 Study (USDA, 2016), about 78% of operations in the U.S. feed milk (saleable or unsaleable) alone or with milk replacer. If we assume that most of the milk fed to calves is unsaleable, it is clear that a significant number of calves in the U.S. receive waste milk prior to weaning.

The potential presence of antibiotics and/or antibiotic-resistant bacteria are a concern when feeding waste milk. I have reviewed the idea of feeding waste milk to calves in several Calf Notes (#35, #98, #119, #146, and #193). Generally, we understand that feeding waste milk my influence antibiotic resistance or shedding of antibiotic resistant bacteria; however, the relative risk of this occurring is unclear. However, some recent research in the Journal of Dairy Science attempted to answer the question – *"If I feed waste milk, what is the risk of increasing antibiotic resistance in my calves specifically and on my farm in general?"* This is an important question because the genes that encode for antibiotic resistance have been shown to "move" from one species of bacteria to another (see this Wikipedia article for more information). Increasing antibiotic resistance even in non-pathogenic bacteria increases the risk of antibiotic resistance in potentially pathogenic bacteria and may reduce the efficacy of antibiotics used for calves and cows – and humans – in the future.

The Research

A study in the Journal of Dairy Science by Duse et al. (2015) reported the results of a survey 243 farms in Sweden. Management practices were reported and fecal samples from 729 calves from 7 to 28 d of age were collected (median age = 15 days). The researchers analyzed fecal samples for the presence of antibiotic resistant *Escherichia coli* (resistance to numerous antimicrobial compounds). They then evaluated relationships among management practices (including feeding colostrum and milk from treated cows) and fecal shedding of antibiotic resistant *E. coli*. Overall. They found that *E. coli* resistant to streptomycin, nalidixic acid, or cefotaxime were isolated from 90, 49, and 11% of the calves, respectively. About half of the calves (48%) had a random isolate of *E. coli* resistant to at least one compound. Several management factors were associated with shedding of resistant *E. coli*; however, the feeding of waste milk was a significant risk factor to shedding of resistant *E. coli*. Interestingly, feeding colostrum and transition milk from cows that were treated at drying-off was NOT associated with shedding of resistant *E. coli*, suggesting that proper withdrawal periods are useful in reducing risk of transmitting antibiotic resistance.

Canadian researchers (Babafela and Smith, 2017) took a different approach to quantify the risk of calves shedding antibiotic resistant bacteria in feces following the feeding of waste milk. These researchers used a Monte Carlo simulation model to estimate the increase in number of calves that would shed cephalosporin resistant *E. coli* when fed waste milk. A "Monte Carlo simulation" is a computer model, usually containing thousands of simulated "animals". Each "animal" (think of it as a row in a spreadsheet containing data for one animal) contains various characteristics of interest.

In this case, the researchers included the percent of farms using waste milk, days waste milk was fed, amount of milk fed, prevalence of antibiotic-resistance *E. coli* and concentration of *E. coli* in waste milk. The authors then calculated additional parameters to determine the increase in number of calves shedding resistant *E. coli* when fed waste milk. Readers interested in more detail of the simulation are encouraged to review this interesting paper in the Journal of Dairy Science (link here).

Overall, the authors reported that the risk of shedding antibiotic-resistant *E. coli* by calves fed waste milk throughout the weaning period was 5.7 calves per 1,000 calves fed. The simulation assumed that 5.7% of samples of waste milk contained antibiotic-resistant *E. coli*. When the prevalence of *E. coli* was reduced to 3, 1.5 and 1%, the daily risk of shedding decreased by factors of 50, 65, and 82%, respectively.

The authors made numerous assumptions in this study to conduct their simulation due to a lack of data regarding dose-response relationships of antibiotic-resistant *E. coli* in milk-fed calves. However, notwithstanding the assumptions, waste milk feeding clearly increases the number of calves shedding antibiotic-resistant bacteria. The extent to which pasteurization can mitigate this risk is unclear, however. According to the USDA NAHMS Dairy 2014 (USDA, 2016) study, 72.9% of small dairy farms (<30 cows) in the U.S. feed unpasteurized milk (including both saleable and unsaleable), whereas 26.3% of large farms (>500 cows) utilize unpasteurized milk. Thus, the risk seems significant that waste milk contributes to the prevalence of antibiotic-resistant bacteria on dairies.

Summary

Additional information recently published suggests that the use of waste milk on dairies contributes to shedding of antibiotic-resistant bacteria by milk-fed calves. On farms where waste milk is fed, it is estimated that 5.7 of 1,000 calves will shed antibiotic-resistant *E. coli*. The extent to which these bacteria contribute to overall farm antibiotic-resistance and the effect to which pasteurization is effective in reducing this risk are still unknown.

References

Babafela, B. A. and B. A. Smith. 2017. Risk assessment modelling of fecal shedding caused by extended-spectrum cephalosporin-resistant *Escherichia coli* transmitted through waste milk fed to dairy pre-weaned calves. J. Dairy Sci. https://doi.org/10.3168/jds.2017-13196.

Duse, A., K. Persson Waller, U. Emanuelson, H. Ericsson Unnerstad, Y. Persson, and B. Bengtsson. 2015. Risk factors for antimicrobial resistance in fecal *Escherichia coli* from preweaned dairy calves. J. Dairy Sci. 98:500–516.

USDA. 2016. Dairy 2014, Dairy Cattle Management Practices in the United States, 2014. USDA–APHIS–VS–CEAH–NAHMS. Fort Collins, CO. https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy14/Dairy14_dr_PartI.pdf.

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