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Calf Note 208 – Management factors and respiratory disease in preweaned calves

Introduction

Disease in young calves – digestive and respiratory – are common, particularly in the first two months of life. According to the most recent (2014) USDA National Animal Health Monitoring System (NAHMS) survey, preweaning mortality and morbidity in the United States were 5% and 34% of calves sampled in the NAHMS survey. I reviewed these statistics in Calf Note #203. The authors of the research report (Urie et al., 2018) reported that the primary factors associated with preweaning disease

An article in the Journal of Dairy Science (Maier et al., 2019) recently reported results from a survey of 100 dairy farms and calf ranches in California and evaluated the factors associated with incidence of bovine respiratory disease (**BRD**). This Calf Note will review selected results and implications of this interesting and important research. More information is available from the Journal of Dairy Science article.

The Research

California dairy farms (n = 105) were visited from May 2014 to April 2016 to score a random number of calves and collect biographical, feeding and management data associated with each animal. Then, each calf in the study was scored for BRD using the California BRD scoring system (Love et al., 2014). Calves are given a score for the following clinical signs: 2 points for cough, ocular discharge, dyspnea, or a rectal temperature of ≥39.2°C (102.5°F); 4 points for nasal discharge; and 5 points for a head tilt or ear droop. A calf with ≥5 points is positive for BRD.

It's important to put into perspective California dairies to understand the results reported by the researchers. First, these dairies are *big*. The average herd size in this study was 1,718 cows and ranged from 110 to 14,000 cows. They also typically house calves *individually* in *hutches*, which can be constructed of metal or wood. In the study, about 92% of calves were housed individually in hutches until shortly after weaning (79 days of age) and moved into group housing (at about 80 days of age). Most calves will be fed liquid by *bucket* or *nipple bottle*. Auto-feeders are uncommon, particularly on large dairies. It's also common to feed a fixed volume of liquid (most commonly 1.8 L) at each of two daily feedings. It can be *hot* in the summer, particularly in the Central Valley. Therefore, strategies to reduce heat stress, such as shades over hutches, are common and have been shown to improve calf health and performance.

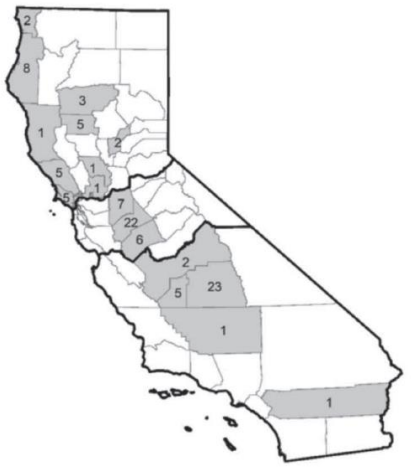
Before weaning, it's common for California dairies to feed fresh milk, pasteurized waste milk, and/or milk replacer.

The Results

Prevalence of BRD in preweaned calves on the 100 dairies sampled was 6.9%. Of the 4,636 calves evaluated, 320 scored positive for BRD. The range on farms was 0 to 37%. There were no significant effects of breed (Holstein = 7.2%; Jersey = 5.7%; other breeds = 5.7%), sex (heifers = 6.4%; bulls = 8.4%), or conventional vs. organic (6.9 and 7.8%, respectively).

The researchers reported that age influenced the prevalence of BRD. For calves <40, 4-75, and >75 days, the prevalence was 4.5[a], 10.6[b], and 6.4[abo]%, respectively. The superscripts ([a], [b], or [ab]) indicated statistical differences. So, prevalence in calves <40 days (4.5%) was lower than calves 40-75 days (10.6%) and prevalence in older calves was intermediate.

Region of the state also affected prevalence of BRD. The authors divided the state in three regions (see Figure 1). Prevalence in Northern California, San Joaquin Valley and Southern CA were 9.3[a], 4.5[b] and 7.3[a]%, respectively. Finally, herd size affected prevalence, also. Prevalence by herd size was 10.0, 5.7, 4.4, and 10.7% for herds <250[ab], 250-999[ac], 1,000-3,999[c] and 4,000[b] or more cows, respectively. The superscripts indicate that herds between 250 and 3,999 generally had the lowest prevalence and largest and smallest herds had highest prevalence.



Map of counties in northern California (top section), northern San Joaquin Valley (middle section), and greater southern California (bottom section). Shaded areas contain counties and number of dairies per county sampled for a study of 100 California dairies surveyed between May 2014 and April 2016 relating management practices to bovine respiratory disease prevalence.

Figure 1. From Maier et al., 2019.

It's important to understand that making predictions from these individual variables may be fraught with error. That's because, for example, more medium size herds might be located in the San Joaquin Valley, or it's possible that herds were visited at times of the year when the weather was better than other times of the year. So, these variables are often related to one another, so that making predictions about one requires knowledge about another variable. Fortunately, there's a better, more sophisticated approach to determining with factors are truly related to BRD. The researchers used a *multivariate logistic regression model*, which looks at factors *and their interrelationships* to determine causation. It's a terrific statistical approach (but not for the timid!).

Factors increasing risk of BRD

The authors reported management factors that increased the risk of preweaned calves developing BRD and those that decreased that risk. Factors that increased risk of BRD included lagoon water to flush under hutches; season; metal hutches; calf to calf contact in older calves and feeding Holstein calves <2.84 L./day of milk or milk replacer per day. Let's look at each in turn.

Lagoon water. Some dairies utilize lagoon water to flush away feces and urine from under calf hutches (typically, California hutches are raised above the ground). Flushing may occur once or twice daily. The "odds ratio" of BRD when using lagoon water was 2.49. This means that, compared to no flushing, calves were 2.49 higher odds of developing BRD compared to no flushing.

Note that an odd ratio of 1.0 means that there is no difference between the "referent" (the thing you're comparing against – in this case, no flushing) and the thing you're measuring. In this case, an odds ratio of 2.49 means that this is a management practice with a strong relationship to the observed incidence of BRD.

Clearly, using contaminated water to flush lagoons contributed to BRD. It's possible that ammonia, methane and other volatile compounds from urine in lagoon water could impair respiratory function and contribute to BRD. The possibility that respiratory pathogens could be transmitted by contaminated water also exists. It's noteworthy that using fresh water was not associated with increased incidence of BRD.

Season. Calves tested in the fall had greater odds of BRD compared to spring. Other comparisons weren't important. It's likely that more variable fall weather contributed to additional stress and predisposed calves to BRD.

Metal hutches. In the survey, the term "metal hutches" referred to a number of structures – hutches with metal roofs, hutches without roofs but inside a structure such as a barn and other structures. Thus, it's difficult to state unequivocally what contributed to increased incidence of BRD. Perhaps a combination of summer heat and metal roofs could cause significant heat stress and could impair a calf's immune response, predisposing it to BRD.

Calf to calf contact. Allowing older calves to touch each other was associated with an increased risk of BRD on these dairies. When calves were >75 days in the hutch and allowed to touch other calves, the odds of a calf getting BRD were increased compared to younger calves that could touch one another. Also, all calves >75 d old had almost 3 times higher odds of BRD than those <40 d of age. Finally, calves 40 to 75 d old had over 3 times higher odds of BRD compared with calves <40 d old. Clearly, age, development of the immune system, exposure and calf-to-calf contact are important predictors of BRD on these farms.

Feeding too little liquid. The authors reported significant relationships between amount of liquid fed prior to weaning and breed of animal. They compared the odds of BRD in Jersey or Holstein calves both fed <2.84 L/day of liquid (<3 quarts/day). The odds of BRD were much greater in Holstein calves, suggesting that this volume of liquid may be too low to maintain immunity in the larger Holstein calf. Indeed, calculation of maintenance energy requirements suggests that 3 L/day of milk replacer will not provide sufficient energy for maintenance energy under many practical conditions. However, the authors cautioned that there were very few calves fed these high amounts of liquid in their database and the results needed to be interpreted with caution.

Factors decreasing risk of BRD

The study analysis found several management factors associated with lower odds of calves having BRD during the study. These included shade cloth, feeding pasteurized milk, increasing liquid fed, particularly to Jersey calves. Let's look at each.

Shade. Use of shade cloth above hutches (the majority of which were outside in the sun) reduced the odds of BRD on the farms evaluated. The odds ratio was lower when shade with sufficient ventilation (not complete enclosures) was used. This difference was highly significant, suggesting

that reducing sun and precipitation exposure helped maintain immune response and reduce odds of getting BRD.

Feeding pasteurized milk. Feeding pasteurized milk significantly reduced the odds of calves developing BRD compared to unpasteurized milk. This makes perfect sense, as pasteurization of non-saleable milk is effective in reducing the microbial load and potential pathogens. It's an important practice on all dairy farms that use non-saleable milk.

Feeding saleable milk. If a calf was fed at least 90% saleable milk for 7 d or more prior to the researcher's visit, it was considered to be receiving saleable milk. Like feeding pasteurized milk, these calves had significantly lower odds of having BRD compared to non-saleable milk (pasteurized or unpasteurized). Presumably, the biological reason for this is similar to feeding pasteurized milk.

Amount of liquid fed. Feeding Jersey calves >5.8 L/day of milk was associated with lower odds of BRD. Like Holsteins fed <2.8 L/day of milk, there were few data in the dataset, and authors cautioned that the results needed to be interpreted with caution.

Factors without effect on BRD

The authors measured several variables, but found that they did not affect the incidence of BRD in their study. Some of these included colostrum management (amount, type, pasteurization) and vaccination of calves or cows. It's possible that there were generally few differences among farms, which makes calculation of odds ratios difficult. Intuitively, we understand that proper colostrum management and vaccination programs are important tools to minimizing the risk of BRD.

Summary

My interpretation of these data point to a critical aspect of calf management – stress. Proper housing, including shade to minimize heat and cold stress as well as housing that reduces hutch heat (i.e., avoiding metal roofs) can go a long way to reducing odds of calves developing BRD. How? It's most likely associated with reducing stress and supporting a calf's immune system. Ditto for feeding too little liquid to Holstein calves. This is not a common feeding strategy, but this study (and many others) indicated that feeding calves at or below maintenance energy requirements can have a profound impact on immunity.

The other factors that I think of regarding risk of disease are the competence of a calf's immune system and exposure. Clearly, feeding pasteurized or saleable milk reduced exposure and risk of BRD. Using contaminated water to wash under hutches probably both impairs immunity and may increase exposure. In general, it appears to be a bad idea.

How we feed, house and manage preweaned calves has significant effects on their risk of disease. Increasingly, we understand that disease during the first few months of life can have long term effects on future milk production and, ultimately, profitability of the dairy farm.

References

Love, W. J., T. W. Lehenbauer, A. L. Van Eenennaam, C. M. Drake, P. H. Kass, T. B. Farver, and S. S. Aly. 2016b. Sensitivity and specificity of on-farm scoring systems and nasal culture to detect bovine respiratory disease complex in preweaned dairy calves. J. Vet. Diagn. Invest. 28:119–128. https://doi.org/10.1177/1040638715626204.

Maier, G. U., W. J. Love, B. M. Karle, S. A. Dubrovsky, D. R. Williams, J. D. Champagne, R. J. Anderson, J. D. Rowe, T. W. Lehenbauer, A. L. Van Eenennaam, and S. S. Aly. 2019. Management factors associated with bovine respiratory disease in preweaned calves on California dairies: The BRD 100 study. J. Dairy Sci. 102 (In press) https://doi.org/10.3168/jds.2018-14773.

Urie, N. J., J. E. Lombard, C. B. Shivley, C. A. Kopral, A. E. Adams, T. J. Earleywine, J. D. Olson, and F. B. Garry. 2018. Preweaned heifer management on US dairy operations: Part V. Factors associated with morbidity and mortality in preweaned dairy heifer calves. J. Dairy Sci. 101:9229–9244.