by A.F. Kertz

Gut development predicts calf's life

THE 2017 American Dairy Science Association (ADSA) annual meeting was held in Pittsburgh in June. Over 1,900 attendees from 48 countries participated. Four abstracts related to calves and heifers have been selected for brief review. There were many more such abstracts this year with several coming from other countries. That is a very promising development for calf and heifer research.

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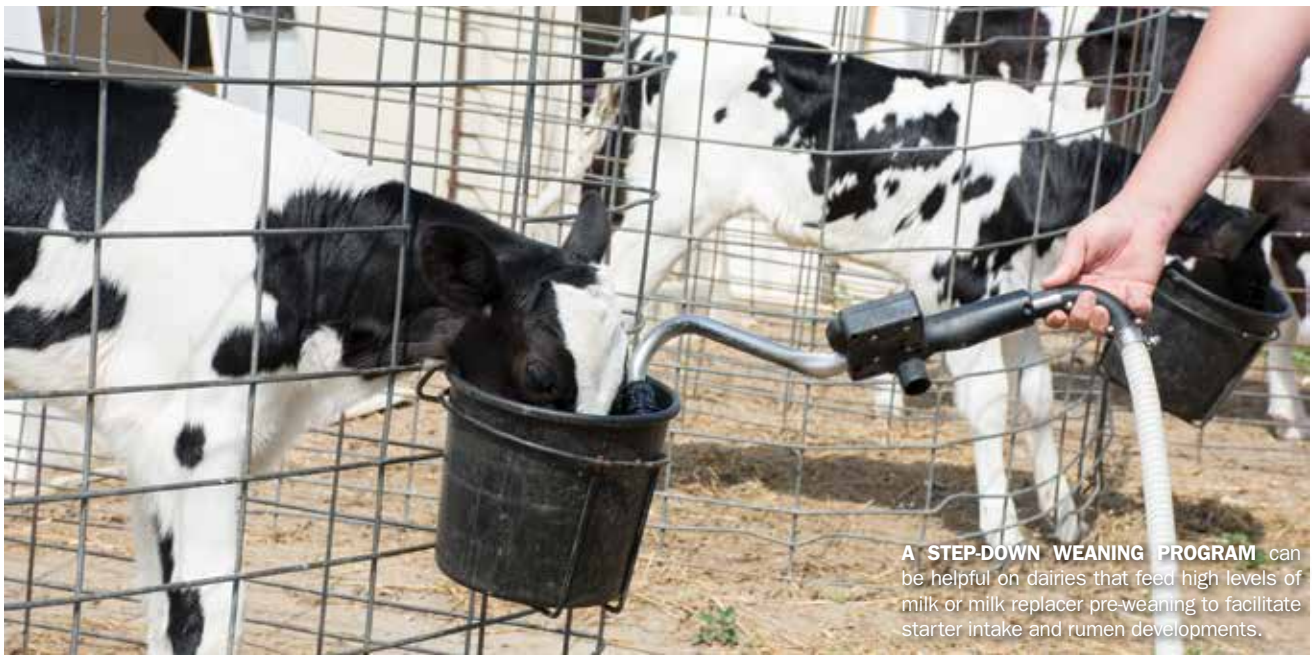

A STEP-DOWN WEANING PROGRAM can be helpful on dairies that feed high levels of milk or milk replacer pre-weaning to facilitate starter intake and rumen developments.

Intestines cue immunity

This was part of a Ruminant Nutrition Symposium entitled "Ruminal Metagenomics in Dairy Cattle — Beyond Microbial Diversity." Because of little understanding of the preruminant gut microbiome, this study characterized the small intestinal (jejunum and ileum) microbiome of preweaned calves. Its aim was to understand the dynamics of postnatal microbial establishment within the first six weeks of life and how it potentially interacts with the host mucosal immune system.

The sequencing of digesta- and tissue-associated communities revealed remarkable variations in the microbial composition and the relative abundance of detected bacterial groups among individual calves. This showed that calves can be grouped into two function-based clusters with either high protein metabolism (cluster1) or sulfur metabolism (cluster2). When the small intestinal transcriptome was profiled, it indicated that the first week after birth is a very dynamic developmental period for the intestinal mucosal immune system.

Similar changes were observed in the expression of microRNA (miRNAs) and microbiome during the first week of life suggesting that these changes observed may be regulated by both miRNAs and microbial colonization. Besides, the ileal transcriptome of the calves belonged to two taxonomic-based clusters revealing varied immune responses. The present study showed that establishment of small intestinal-specific microbiota occurred from birth, regardless of the highly individualized early microbiome. Findings from this study indicate that the colonizing microbiome is an essential factor regulating the rapid development of the mucosal immune system during the first week of life.

Take-home message: What is amazing from this and several other presentations by this and other authors is that the gut microbial population influences the immunity and metabolism of the host animal. Differences in intestinal microbial populations in another study were related to differences in feed efficiency. Somewhat similarly, human obesity has been found to be related to gut microbial population differences. Look for more findings in this area in the near future.

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Colostrum even more vital

While it is widely known that calves are born without immunity and must rely on colostral antibody absorption for their initial immunity, many dairy farms still do not get colostrum fed within the preferable four hours of birth. Even when fed during that time frame, antibody absorption has already been reduced 25 percent since birth.

But there are many other benefits to feeding colostrum since it also contains over 200 bioactive components. Some of those compounds help to exclude pathogenic bacteria from absorption in the calf's gut. This study was done to investigate how delaying the first colostrum feeding impacts the passive transfer of immunoglobulins (IgG), as well as bacterial colonization in the intestine of neonatal dairy calves.

Twenty-seven male Holstein calves were randomly assigned to one of three treatments at birth: fed colostrum before one hour after birth, fed at six hours after birth, or fed at 12 hours after birth.

Calves were fed pooled colostrum at their respective feeding times at 7.5 percent of birth body weight and fed milk replacer at 2.5 percent every six hours thereafter. At 51 hours of life, calves were euthanized, and tissue and digesta of the middle and lower segments of the small intestine and the colon were collected. Calves fed colostrum in the first hour had significantly higher serum IgG concentrations (24.77 ± 1.91 g/L) compared with six-hour (17.13 ± 0.91 g/L) or 12-hour calves (16.88 ± 1.50) g/L, while no differences existed between six-hour and 12-hour calves. In addition, zero-hour calves had a greater prevalence of *Bifidobacteria* (1.24 ± 0.64) and *Lactobacillus* (0.26 ± 0.08) attached to colon tissue compared with those fed at six and 12 hours (0.12 ± 0.02 and 0.07 ± 0.02, respectively).

In contrast, there were no differences in *E. coli*, *Clostridium*, and *Fecalibacterium* colonization among treatments in the digesta or tissue of the middle portion of the small intestine. These findings suggest that feeding dairy calves colostrum immediately after birth can increase the passive transfer of IgG and the colonization of beneficial bacteria in the colon; both of which are hypothesized to assist in protecting the calf from enteric infections during the preweaning period.

Take-home message: Feeding calves 3 to 4 quarts of high-quality, clean colostrum shortly after birth not only benefits blood IgG levels but can also benefit the "good" bacteria in the calf's gut.

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Step down weaning beneficial

This study evaluated three milk replacer feeding (MR) programs on calf performance up to 4 months of age. Forty-eight neonatal Holstein male calves were randomly assigned to either a moderate (MOD) rate of MR (1.45 pounds per day for 39 days then 0.73 pound per day for three days before weaning), a free-choice (FC) rate of MR (offered twice daily between 6:30 a.m. and 8:30 a.m. and between 2:30 p.m. and 4:30 p.m. for 35 days, 1.45 pounds per day for four days, and 0.73 pound per day for three days), or a step-up (SU) rate of MR (increased from 0.73 to 1.45 pounds per day in first 12 days, 1.45 pounds per day for 27 days, and 0.73 pound per day for three days).

The MR (25 percent crude protein, 18 percent fat) was fed twice daily up to Day 39 and once daily thereafter. Texturized starter (40 percent starch, 21 percent crude protein) and water were offered free- choice. Calves were housed in individual pens through Day 56.

The same starter blended with 5 percent chopped grass hay was offered free-choice after Day 56 to calves in group pens. Total MR intake per calf averaged 60 pounds, 112 pounds, and 55 pounds for MOD, FC, and SU programs, respectively. MR intake ranged from 92 to 139 pounds for FC calves.

In the first 56 days, starter intake and feed efficiency were less for FC versus MOD, while fecal scores and abnormal fecal score days were greater for calves fed FC versus MOD. Calves fed SU had lower daily gain than calves fed MOD (1.28 versus 1.45 pounds). In the second 56 days, initial BW was greater for FC versus MOD, though final body weight was not different between MOD and FC or SU.

Calves previously fed MOD had greater daily gain, feed efficiency, and hip width change than calves fed FC. Though body weights were greater at weaning when MR was fed free-choice, calves were less efficient and growth advantages were lost by 4 months of age.

Take-home message: Feeding greater amounts (6 to 12 quarts daily) of milk or milk replacer before weaning makes weaning more difficult due to lower starter intake during the four-week transition period. This can negatively affect intake and daily gain after weaning. Consequently, there has to be more of a step-down program over several weeks in order to facilitate starter intake, rumen development, and to minimize neg-

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ative effects after weaning.

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Efficiency not tied to RFI

One-hundred twenty-eight pre-bred 4- to 9-month-old Holstein heifers with different predicted genomic residual feed intakes (RFI) as lactating cows were offered diets with different energy levels. Dietary treatments were a high-energy (HiE) diet (HiE; 66.6 percent total digestible nutrients, 14.0 percent crude protein, and 36.3 percent neutral detergent fiber, dry matter basis) and low energy (LoE) diet (63.8 percent total digestible nutrients, 13.5 percent crude protein, and 41.2 percent neutral detergent fiber, dry matter basis). Each pen of heifers was randomly assigned to treatments to obtain a 2x2 factorial arrangement (two RFI levels and two diet energy levels). Diets were fed in a 120-day trial.

Dry matter intake was not affected by diet, or by RFI, respectively. Daily gain was affected by diet with heifers fed HiE having greater daily gain than heifers fed LoE (2.51 versus 2.14 pounds per day). Also, RFI affected daily gain with LoRFI heifers having greater daily gain than HiRFI (2.40 versus 2.25 pounds per day). Feed efficiency was improved for heifers fed the HiE diet (6.44 versus 8.02 pounds dry matter intake per pound gain for HiE and LoE, respectively), but was not affected by RFI.

Overall, feed efficiency of pre-breeding heifers was not dependent on genomic RFI. Heifers with LoRFI had greater daily gain but this was likely due to a numerical increase in intake. Feed efficiency of heifers was reduced when heifers were fed the LoE diet, but it resulted in more optimal daily gain than feeding a higher energy diet free-choice.

Take-home message: Because of high variability in performance with calves and heifers, large numbers of animals are often needed to detect small differences. In this case, 128 heifers may not have been enough to relate genomics to heifer performance. The author did note that they had detected differences in genomic RFI when feeding pregnant heifers using the same design. They found a difference between low and high RFI when fed for gains in the 1.8 to 2 pounds per day range, but not at higher gains possibly due to higher efficiency with a higher energy diet. They think this may be a similar issue in this study with all gains being greater than 2.1 pounds per day.

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