Feedstuffs, November 7, 2016 **Feedstuffs** Reprint

Take care when transitioning calves to different diets

Bottom Line

with
AL KERTZ*

UNFORTUNATELY, at times, calf growers cannot wait to get calves off a starter and onto a total mixed ration (TMR). They may want to do this to reduce feed costs and to simplify by using a TMR that also is being fed to other heifers or even to lactating cows.

I have generally recommended against this practice for several reasons: this is a key transition period for calves after weaning; using TMRs formulated for other groups will not likely have the right forage and nutrient content for calves, and this will likely lead to gut fill that may reduce intake and average daily gain (ADG).

Consequently, a study done at the University of Guelph in Ontario was of prime interest (Overvest et al., 2016).

Male Holstein calves purchased locally in Ontario were used in two blocks (April to July and July to October) of 24 calves with four treatments running for 12 weeks. Calves were verified to have received at least one feeding of colostrum, were assessed by study technicians to be healthy and alert and were subjected to standard operating procedures and animal care guidelines.

Housing was in a three-sided building with three-sided pens inside the building. There were two pails holding solid feeds on the front metal gate and another pail inside the back for water.

Calves were fed, through an artificial teat, up to 12 liters (4 lb. of dry matter) daily of acidified milk replacer mixed at 15% solids and containing 26% protein and 16% fat. After 38 days, milk replacer was reduced by one liter daily until calves were fully weaned at day 50.

The four feed treatments were:

1. A TMR with dry matter comprised of 37% corn silage, 34% red clover hay, 16% high-moisture corn and 13% protein concentrate, along with rumensin, resulting in 15.2% protein, 21.4% acid detergent fiber (ADF) and 31.7% neutral detergent fiber (NDF) on an as-fed moisture basis.

2. A texturized (see comments below) starter containing 20% protein mixed with 15% chopped grass hay at a particle size of less than 2.5 cm with 8.3% protein, 38.6% ADF and 61.1% NDF (MIX).

3. The same as MIX except that the chopped hay and starter were fed separately (SEP).

4. Just the starter as the control.

Amounts fed were free choice to result in 15% weigh-back. After eight weeks, the 15% hay treatment fed separately was fed as a mix, so only three treatments remained through 12 weeks.

Milk replacer dry matter intake (DMI) was similar among treatments before weaning and averaged about 3 lb. of dry matter daily. During weaning, milk replacer DMI was again similar among treatments and averaged about 2.2 lb. Consequently, DMI from solid feed was very low before and during weaning, as would be expected (Kertz and Loften, 2013).

Other observations included:

• **Before weaning**, ADG was greater than 1 kg (2.2 lb.) daily. This is a concern because that's about the maximum rate of protein deposition for growing dairy calves/heifers without undue fattening.

Also, at an early growing phase, fat deposition occurs primarily by hyperplasia — an increasing number of adipocytes or fat cells. Later, fattening occurs primarily by hypertrophy — an increase in the size of fat cells. So, the more fat cells that are present early, the greater the animal's propensity for fattening more easily later. Notice the very high feed efficiencies before weaning (Table) approaching that of growing pigs and chickens. That is because the calves' diet then was almost entirely milk replacer, which would have a digestibility in the 90% range.

• **During weaning,** ADG decreased to about 1 lb. daily, except for the TMR treatment. However, ADG was less than one-half of what it was during the preweaning period, indicating several things. Since solid feed intake was so low before weaning began, rumen capacity and functional development would have been limited. Even though there was a 10-day weaning process, that was not adequate time to compensate for the limited solid feed intake before weaning.

That trade-off has to be managed more carefully (Kertz and Loften, 2013). Even with less milk replacer intake (a daily average of about 2.2 lb.) than before the weaning process began, the ratio of milk replacer DMI to solid feed DMI was about 2:1, when it should be the inverse, or no more than 1:1, for a good weaning transition program — the two weeks before and two weeks after full weaning (Stamey et al., 2013; Kertz and Loften, 2013).

The total DMI during the weaning process (about 3.2 lb. per day) was the same as the total DMI for the preweaning period. However, since the calves had grown, their maintenance requirements would have been greater, which is why their ADG averaged only 37% during this period compared to preweaning. Consequently, gain:feed ratios were also reduced by 68%.

The TMR treatment did not differ statistically from the other treatments in DMI, ADG and gain:feed preweaning because all of the treatments had such low solid feed DMI. Calves on the TMR

Performance of calf feeding treatments

Item	Control	MIX	SEP	TMR
Preweaned, 0-38 days				
Solid feed intake, lb. DM/day	0.18	0.22	0.20	0.07
ADG, lb./day	2.42	2.42	2.42	2.20
Gain:feed	0.76	0.79	0.75	0.67
Rumination time, min./hour	5.0	5.4	7.5	5.9
Weaning, 39-49 days				
Solid feed intake, lb. DM/day	1.00	1.10	1.11	0.42
ADG, lb./day	0.88	1.10	1.10	0.44
Gain:feed	0.28	0.31	0.30	0.07
Rumination time, min./hour	6.3	17.8	11.1	11.9
Weaned, 50-84 days				
Solid feed intake, lb. DM/day	5.90	5.88	6.32	3.92
ADG, lb./day	2.64	2.64	2.64	1.54
Gain:feed	0.50	0.62	0.50	0.43
Rumination time, min./hour	18.3	17.8	17.3	19.8

*Dr. Al Kertz is a board-certified, independent dairy nutrition consultant with ANDHIL LLC based out of St. Louis, Mo. His area of specialty is dairy calf and heifer nutrition and management.

treatment had solid feed DMI, ADG and gain:feed results that were considerably less ($P < 0.05$) than calves on the other treatments during this weaning period.

In fact, it is debatable whether calves on the TMR treatment actually had any true growth or whether the ADG was largely due to gut fill. Gain:feed was also much lower for all treatments compared to the preweaning period, reflecting less milk replacer intake and more solid feed intake.

Rumination time was lower ($P < 0.05$) for the control starter alone versus the MIX treatment.

• **Weaned period.** After full weaning, calves on the TMR treatment struggled, having considerably lower ($P < 0.05$) DMI and ADG compared to the other three treatments. This is indicative of the treatment's 71% forage content, lower digestibility than other treatments and lower DMI, the latter due to a longer residence time in the rumen, a slower rate of rumen fermentation, more gut fill and slower rate of passage. Rumination times were similar among treatments.

Now, some caveats. Whenever forage is fed to young calves, gut fill is a confounding factor — whether realized, measured or not. For instance, a study by Khan et al. (2011) is often cited, as it was by Overvest et al., because it found that hay intake improved solid feed intakes and led to more normal rumen development.

Two factors were ignored in that assessment. First, the starter fed was claimed to be "texturized," but it clearly was not well-texturized because all of the coarse grains were unduly processed, and that fraction was only 37% of the total starter. Evidence of poor texturization included that rumen pH, measured at sacrifice, was only 5.06, compared with 5.49 when chopped orchardgrass hay was also made available.

(Calves seem to sense when they are ruminally acidotic, such as when fed only pelleted or meal starters, and often titrate their acidity by chewing on wood to salivate more and buffer their own marginal ruminal acidosis. In the 1980s, when an all-pelleted starter was introduced in the northeastern U.S., calves had a field day chewing up any available wood.)

Calves' DMI was greater from hay and starter versus only starter, but ADG was similar between the two treatments. However, the rumen-reticulum with digesta was 10.4 lb. more when hay was also fed. Thus, these calves actually gained less total bodyweight, belying the title of this paper (Khan et al., 2011; *Feedstuffs*, Sept. 13, 2011, and July 14, 2014).

The other major caveat with the Ontario trial is that the starter was texturized. Consequently, there was no advantage in including hay among the three non-TMR treatments. In Overvest et al., comparisons were made to other studies by Castells et al. (2012), Castells et al. (2015) and Montoro et al. (2013), but those are not appropriate comparisons because texturized starters were not fed in those studies. That is like comparing apples to oranges, as shown in studies by Porter et al. (2007) and Hill et al. (2008).

So, the results of Overvest et al. apply only when using a texturized starter. Thus, it is not surprising that the treatment with texturized starter alone did well without hay being fed.

Once, I was on a large dairy in the western U.S. that was feeding a well-texturized calf starter without any hay. I was astonished (and do not recommend this) to find out that the dairy was not feeding any hay to calves through at least four months of age and had daily intakes as high as 8-12 lb. That indicates the particle size effect of a well-texturized starter. I recommended that the farm begin to feed 1 lb. daily of alfalfa hay during the third month and double that in the fourth month while limiting the texturized starter intake to 6-8 lb. daily.

The Bottom Line

Feeding forage with a well-texturized calf starter is not necessary or beneficial during the first two to possibly three months based on the Overvest et al. study. Feeding calves a TMR, especially with 71% forage, decreases DMI and ADG and most likely leads to gut fill during the first three months.

I recommend waiting until after four months of age to begin feeding a TMR to calves, and then, maybe begin with 40-50% forage, depending on the quality of forage used and the grower supplement.

References

Castells, L., A. Bach and M. Terre. 2015. Short- and long-term effects of forage supplementation of calves during the preweaning period on performance, reproduction and milk yield at first lactation. J. Dairy Sci. 98:4748-4753.

Castells, L., A. Bach, G. Araujo, C. Montoro and M. Terre. 2012. Effect of different forage sources on performance and feeding behavior of Holstein calves. J. Dairy Sci. 95:286-293.

Hill, T.M., H.G. Bateman J.M. Aldrich and R.L. Schlotterbeck. 2008. Effects of the amount of chopped hay or cottonseed hulls in a textured calf starter on young calf performance. J. Dairy Sci. 91:2684-2693.

Kertz, A.F., and J.R. Loften. 2013. A historical perspective and brief review: Holstein dairy calf milk replacer feeding programs in the U.S. Prof. Anim. Sci. 29:321-332.

Khan, M.A., D.M. Weary and M.A.G. von Keyserlingk. 2011. Hay intake improves performance and rumen development of calves fed higher quantities of milk. J. Dairy Sci. 94:3547-3553.

Montoro, C., E.K. Miller-Cushon, T.J. DeVries and A. Bach. 2013. Effect of physical form of forage on performance, feeding behavior and digestibility of Holstein calves. J. Dairy Sci. 96:1117-1124.

Overvest, M.A., R. Bergeron, D.B. Haly and T.J. DeVries. 2016. Effect of feed type and method of presentation on feeding behavior, intake and growth of dairy calves fed a high level of milk. J. Dairy Sci. 99:317-327.

Porter, J.C., R.G. Warner and A.F. Kertz. 2007. Effect of fiber level and physical form of starter on growth and development of dairy calves fed no forage. Prof. Anim. Sci. 23:395-400.

Stamey, J.A., N.A. Janovick, A.F. Kertz and J.K. Drackley. 2012. Influence of starter protein content on growth of dairy calves in an enhanced early nutrition program. J. Dairy Sci. 95:3327-3336. ■