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Weaning calves using automatic feeders still a work in progress

Bottom Line

with
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WITH more use of automatic feeders for milk or milk replacer, various questions have come to the forefront. One of those questions is how best to use those feeders to feed more milk or milk replacer yet still have a good weaning process. That was the approach taken in a study by de Passille and Rushen (2016).

The study was done at the University of British Columbia using 56 female Holstein calves with an average birth weight of 89.2 (± 9.9 lb.) and was done over a period of a year. With three treatments, that means fewer than 20 calves per treatment were used, which can result in considerable variation, as we will see. The authors acknowledged that this experimental design limited their ability to detect statistically significant differences — an issue pointed out in a 2004 review (Kertz and Chester-Jones, 2004).

Conducting a study over a period of a year also introduces variation due to the seasons.

All calves were given four liters of colostrum within six hours of birth. Serum protein via a refractometer had to be greater than 5.5 g/dL, or else the calves were not used in the trial. Calves were housed individually in 6.6 ft. x 3.6 ft. pens that were bedded with sawdust on concrete. While in the pens, calves had unlimited access to pasteurized waste milk from the herd, but no water or starter was provided from two to four days of age.

At five to six days of age, calves were moved into 23.0 ft. x 15.4 ft. group pens, which had a 14.7 ft. x 15.4 ft. sawdust-bedded area with a plastic-coated, expanded metal area of 8.3 ft. x 15.4 ft. in front of the automated feeders. Since groups had five to nine calves, the total area per calf ranged from 40 to 70 sq. ft. Calves then were allowed 12 liters per day of herd milk, which averaged 3.97% fat, 4.10% protein and 3.3% lactose.

A "texturized" calf starter was available *ad libitum*, but it contained 16% wheat, 14% barley, 13% oats, 10% corn, 13% canola meal, 10% soy and 4% molasses. If the first four ingredients were unprocessed, that sums to 53%, but it is likely that they were all processed to some extent. Nutrient content was 90% dry matter, 5.0% fat, 38.5% starch, 5.86% water-soluble carbohydrates, 6.8% crude fiber, 8.56% acid detergent fiber (ADF), 22.4% neutral detergent fiber (NDF) and 20% crude protein (CP). Water and grass hay were also available free choice, with the latter having 90.8% dry matter, 15.1% CP, 51.1% NDF and 33.6% ADF.

Digestible energy values used were 5.59 Mcal/kg for milk, 3.48 Mcal/kg for starter and 2.40 Mcal/kg for hay.

The weaning treatments were:

1. Early weaned (n = 14) — Calves were fed 12 liters per day upon arrival in the group pens, weaning began on day 40 and calves were weaned gradually until full weaning on day 48.
2. Late weaning (n = 14) — Calves were fed 12 liters per day from arrival in group pens until 80 days, when milk was gradually reduced until full weaning at day 89.
3. Weaned by starter intake (n = 28, but there was no explanation as to why there were twice as many calves on this treatment) — Weaning began when the average starter intake of the preceding three days was 0.44 lb., and full weaning occurred when calves had consumed an average of 3.08 lb. daily.

Progressive weaning was calculated by intermediate targets of 1.32 lb. and 2.2 lb. of daily starter intake. When calves reached that target intake for the preceding three days, their milk allowance was reduced by three liters per day until full weaning.

My concern with this approach is that these were short time periods overall for weaning and for the intermediate intervals. We know from studies with cows particularly before and after calving that intakes, rumen tissue and rumen microbes can take two to three weeks for full transition. When high levels of milk are being fed, such as 12 liters daily, starter intake will be limited. If milk is then fully removed over eight to nine days, even if starter intakes increase accordingly, that still is not providing the two to three weeks needed for calf rumen tissue and microbes to make a full transition.

I know from various field experiences that calves in this type of situation often struggle with intake after weaning from this major change. They may stall out or

1. Bodyweights (lb.) and average daily gains (lb. per day) for calves on various weaning protocols

		------------------Weaning protocol------------------			
Week		Early	Late	Starter intake	P-value
3	Bodyweight	118.0 ± 4.0	111.4 ± 4.4	115.4 ± 2.9	> 0.10
	Daily gain	1.37	1.06	1.25	
6	Bodyweight	150.0 ± 3.1	152.6 ± 3.5	150.4 ± 2.2	> 0.10
	Daily gain	1.52	1.96	1.67	
8	Bodyweight	161.6 ± 5.1[a]	180.8 ± 5.7[b]	170.2 ± 3.5[ab]	0.06
	Daily gain	0.83	2.01	1.41	
10	Bodyweight	186.1 ± 6.3[a]	209.0 ± 5.7[b]	200.0 ± 3.5[b]	0.01
	Daily gain	1.75	2.01	2.13	
12	Bodyweight	220.6 ± 6.4[a]	234.7 ± 7.3[a]	237.8 ± 4.6[b]	0.07
	Daily gain	2.46	1.84	2.70	
13	Bodyweight	238.3 ± 6.2[a]	255.2 ± 6.8[ab]	253.7 ± 4.6[b]	0.09
	Daily gain	2.53	1.50	2.27	
Daily gain since birth		1.64	1.82	1.81	

[a,b]$P < 0.05$

2. Calculated intakes of feedstuffs and digestible energy by various weaning protocols

	----------------Weaning protocol----------------			
Intake, lb.	Early	Late	Starter intake	P-value
Milk	589 ± 53[a]	1312 ± 79[b]	1,020 ± 44[c]	< 0.001
Starter	269 ± 27[a]	94 ± 29[b]	173 ± 19[c]	< 0.001
Hay	54 ± 9	43 ± 10	48 ± 6	> 0.10
Digestible energy, Mcal	593 ± 31	570 ± 34	592 ± 22	> 0.10

[a,b,c]$P < 0.05$.

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even lose bodyweight, which becomes a major stress. Then, they are more susceptible to a drop in immunity, which can result in a respiratory incident that can then impair that calf for life.

The authors also noted the wide ranges when calves were weaned by their starter intake protocol: weaning began at 55 ± 19 days of age, with an age range of 23-82 days; the duration of weaning was 21 ± 11 days of age, with a range of 7-49 days, and weaning ended at 76 ± 11 days, with a range of 58-94 days.

Such wide ranges would make this type of weaning protocol deleterious, impractical and virtually unmanageable on commercial dairies.

Daily gains over the various periods followed a pattern of being lower for early-weaned calves versus late-weaned and starter intake-weaned calves, with these differences being significant after six weeks of age (Table 1). Generally, there were no differences between the late-weaned and starter-weaned treatments, but there were some gyrations from period to period, especially within the starter-weaned calf treatment.

The latter is most likely due to the wide range in ages at which these calves were weaned following the starter feeding protocol established for decreasing milk feeding when starter intake reached previously established benchmarks. A limitation of the late-weaned treatment is that calves were only fully weaned at 89 days of age, just two days before the last bodyweight was taken and the end of the study. I advocate two weeks of data collection without changing groupings or movements of calves after full weaning to allow for postweaning changes in intake, gut fill and bodyweight. Otherwise, the picture of weaning transition is not complete.

What is somewhat striking about this study is the pattern and overall daily gains of early-weaned calves in which weaning began at 40 days and ended at 48 days. Given that an accepted calf bodyweight goal is to double birth weight by the end of two months, and these calves had an average birth weight of 89 lb., then that would require an average daily gain of about 1.5 lb. These calves had gains of 1.45 lb. at the end of six weeks but then gained only 0.83 lb. over the next two weeks, during which full weaning occurred. Thus, the 12-liter feeding level of milk was too great with accompanying low starter intake and the eight days too short to have a good weaning transition and two weeks of postweaning performance.

If, instead of daily gains of 0.83 lb. per day during the six- to eight-week period, gains were double what they should be, then the final impact would be an overall average daily gain for 13 weeks of 1.75 lb. — only slightly below the gains of 1.83 lb. and 1.80 lb. per day for the other two treatments.

As expected, intakes of milk and starter (Table 2) mainly reflected the various milk feeding and weaning programs. Overall, digestible energy intake was similar among treatments, but when and how much milk was consumed would greatly affect efficiencies of gain because of the greatest digestibility of milk and its high fat content. For young calves, greater daily gains without undue fattening increases efficiency because it dilutes maintenance costs per unit of bodyweight gain.

The Bottom Line

The weaning process and transition (two weeks before and two weeks after full weaning) are critical to how calves perform. In this study, early weaning with 12 liters daily milk feeding was too short over eight days with low starter intake, resulting in poorer performance for the two-week period during which full weaning occurred. Late weaning at 13 weeks allowed only two days postweaning — too short of a period. Weaning by established benchmarks for the previous three days' starter intakes was too variable in age and performance and would be difficult to manage in practice.

Automatic feeders can facilitate weaning protocols, but it still is essential to manage how much milk is being fed with the accompanying starter intake in order to understand how best to manage the weaning process in any operation.

References

De Passille, A.M., and J. Rushen. 2016. Using automated feeders to wean calves fed larger amounts of milk according to their ability to eat solid feed. J. Dairy Sci. 99:3578-3583.

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