Dairy Calf Weaning Transition

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There are 3 critical periods for calves (Kertz 2019). The first is around calving, and this includes the cow, calving environment, and the whole area of colostrum feeding and management. The second critical period is during the first 2 weeks of life which is when most diarrhea and deaths occur. And it is directly related to how good or bad the first critical period was managed. The third critical period is the weaning transition which is the 2 weeks before and 2 weeks after full weaning. This period is often overlooked in calf studies (Kertz 2025a) and on-farm, and the results show it--if measured. But, recently there has become more focus on this weaning transition period. At the 2024 American Dairy Science Association (ADSA) meeting, an American Registry of Professional Animal Scientists (ARPAS) symposium was held at which this calf weaning transition subject was addressed by Dr. Jim Drackley of the University of Illinois (Drackley 2025). Another paper from that symposium was addressed in another *Feedstuffs* webinar and article (Kertz 2025b, Marcondes et al., 2025).

Jim Drackley was part of the NASEM 2021 committee which further improved the Young Cal Model first introduced in the NRC 2001. After the 2001 NRC was published, studies were done primarily at the University of Illinois, Cornell University, and Michigan State University which found that the Young Calf Model was not as accurate as it could be because it had been based mainly on larger fattening veal calves. The efficiency of converting metabolizable energy (ME) to retained energy was too high for younger calves depositing primarily protein. The key in revising the Young Calf Model 2021 NASEM (National Academies of Sciences Engineering Medicine) was body composition data on younger calves. The Model continues to allow use of milk replacer alone or in combination with starter to evaluate daily gain. It also predicts starter intake. The model was tested on extensive data scoured from published studies. In three comparisons (Kertz 2022) which I conducted with a range of calf body weights and milk replacers of the 2021 versus the 2001 Young Calf Models, the new model predicted less daily gain by about 0.2 lb per day.

Since the weaning transition period is hardly acknowledged, what evidence is there that this is a problem area? A 2018 NAHMS study was done with data collected from 104 US dairy farms in 14 states (Urie et al., 2018). This dimension was not recognized in the study, but from data in the paper, I was able to extract data in **Table 1.** Those data show that at weaning, calves did very well gaining 1.61 lb daily. And their 2 inches monthly increase in wither heights is appropriate (Kertz et al., 1998). But there was a postweaning slump to 1,32 lb daily gain.

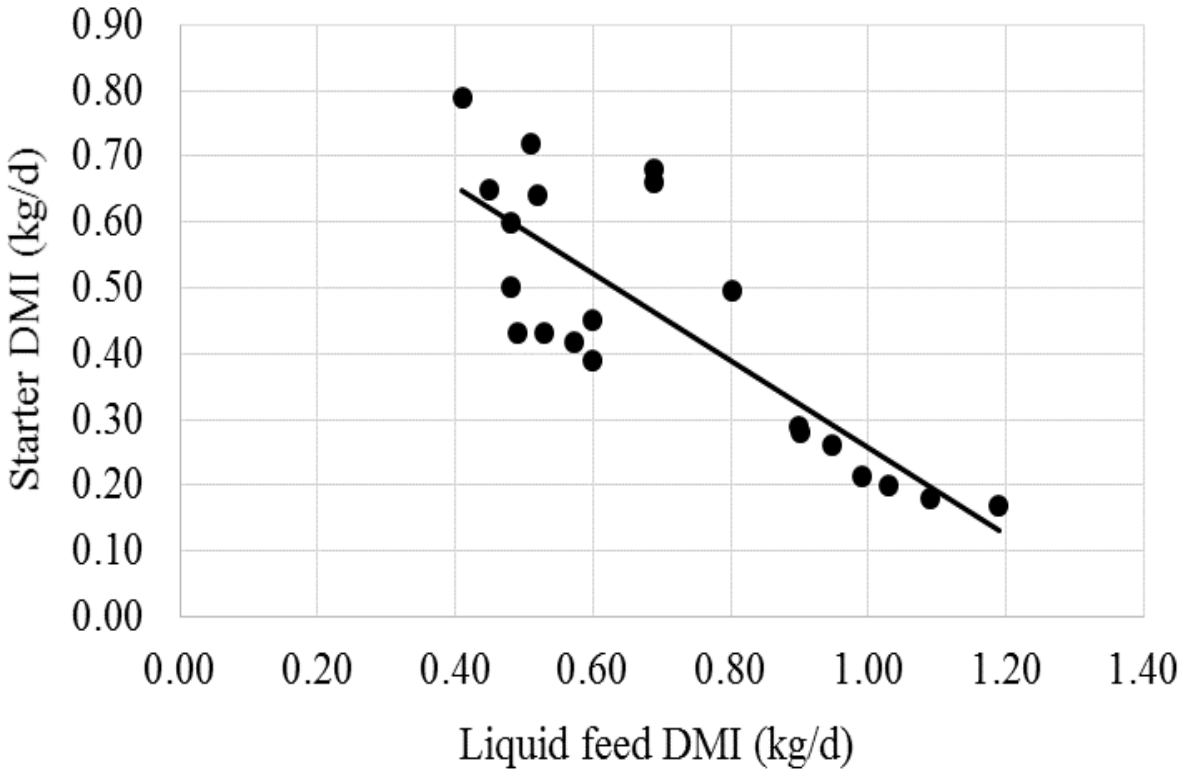
Table 1. Data extracted from Urie et al,, 2018.

Item	Holsteins n =2,273
Birth weight, lb	94.7
Weaning weight, lb	201.3
Daily gain, lb	**1.61**

90-day weight, lb	229.0
Daily gain post-weaned, lb	**1.32**
Birth hip height, inch	32.6
Weaning hip height, inch	37.5
Inch/day	0.07
90-day hip height, inch	38.6
Inch/month	2.01

There are several factors that contribute to post-weaning slump. The major one is **starter intake before weaning** as that largely determines functional rumen development. **Figure 1** depicts the inverse relationship between milk/milk replacer (MR) intake and starter intake. For each 100g additional dry matter fed from milk/MR, 60 g less starter was consumed. For example, if 0.5 lb more milk/MR was fed daily, that would result in 0.3 lb lower starter intake. Over 60 days, that would result in 18 lb less starter intake. Related to that is when starter is first fed.

Figure 1. Relationship between milk/MR intake and starter intake. (Gelsinger et al, 2016). p. 36 in book



I cringe when I read or hear calf "experts" say since calves eat little starter in the first 2 to 4 weeks, it is not critical to begin feeding until then. To the contrary, the earlier calves are fed and eat starter, the more they eat by weaning. I graphed data from Stamey et al., (2012) on page

38 (Kertz 2019), and ***it shows that each week calves approximately doubled their starter intake from the previous week***. ***So, if starter is delayed in being fed or is poor, that means calves eat less starter by the time they are weaned***. And if the starter is not well-texturized, ruminal development will be poorer (Porter et al., 2007).

There is excellent, but rare, discussion (Drackley 2025) and data related to starter and forage intake and gut fill.

Table 2. Total tract digesta at 5 and 10 weeks of age for male Holstein calves and effects on empty body weight (EBW) from Stamey-Lanier et al., 2022.

	LMR + CCS	**HMR + CCS**	**HMR + HCS**	**SEM**
Daily gain 5-10 weeks, lb/day	1.96	1.83	2.03	0.26
5-week digesta, lb	6.25	3.39	3.26	0.75
10-week digesta, lb	22.66	21.01	24.90	2.07
Daily gain due to digesta, lb	0.46	0.51	0.64	----
EBW gain, 5-10 week, lb/day	1.34	1.03	1.28	0.22

1) low rate of milk replacer (**LMR**; 20.6% CP, 21.7% fat, DM basis) plus conventional starter (**CCS**; 21.5% CP, DM basis), **LMR + CCS**; n = 15 calves;
(2) high rate of milk replacer (**HMR**; 29.1% CP, 17.3% fat, DM basis) plus CCS, **HMR + CCS**; n = 15; and
(3) HMR plus high-CP starter (**HCS**; 26.0% CP, DM basis), **HMR + HCS**;

Author Drackley (2025) noted:

- Decrease in true growth of body tissue after weaning makes the typical daily gain measurement even worse.
- Relationships between digesta mass of calves at 0, 5, and 10 weeks of age and either starter intake or live BW equations can be used to estimate gut fill of calves up to 10 weeks of age (but that would only hold true for this and similar studies where a well-texturized starter was fed and with no forage.)
- Along with the increasing gut fill, the mass of the reticulorumen and gastrointestinal tract increases rapidly, growing allometrically compared with the rest of the body (**Table 2).** Before weaning the reticulorumen represented 1.29% to 1.76% of EBW, whereas after weaning the reticulorumen was 2.53% to 3.10% of EBW, depending on diet. The daily gain of the total gastrointestinal tract represented from 14.8% to 23.4% of EBW gain, depending on diet.
- Retained energy in EBW gain decreases during weaning, because the gastrointestinal tract contains less body fat than does the carcass (Van Amburgh et al., 2019). This shift in energy deposition as protein in the gastrointestinal tract and less carcass accretion may appear as a slump in growth when the reticulorumen has not had sufficient development before weaning.

Also discussed was the issue of when to begin feeding forage and its impact when fed at too high a level; along with low rumen pH in preweaned calves. The former is addressed in my book (Kertz 2019) p. 68-75 while the latter is illustrated on p 76-77. Low rumen pH in preweaned calves, I think, is due to lack of a resident functional protozoa population which facilitates higher rumen pH by engulfing starch and deaminating amino acids and protein.

Related to gut fill is a key study which did not recognize what had occurred in their study based on its title and interpretation (Khan et al., 2011). Calves were fed what was described as a "texturized" starter alone or with hay. The starter had "14% flatted barley, 13% flatted oats, and 10% steamed corn" = 37% processed grains. The "texture" only sums to 37% grains which were all processed when a minimum of 45% should be texturized (Ghaffari and Kertz 2021) with minimal grain processing--let the calf do it! In this study (**Table 3**), the poorly texturized starter led to marginal rumen acidosis, which the hay intake "cured" but with major gut fill which confounded true body weight gain. When I pointed this out to the second author, to his credit, he said I should "tell the industry about this."

Table 3. Impact of a poorly texturized starter alone or with hay (Khan et al., 2011).

	Starter	Starter /hay	*P* <
Rumen/ret + digesta, lb	**17.6**	**28.0**	**0.02**
Rumen/ret – digesta, lb	**3.5**	**4.2**	**0.03**
pH	**5.06**	**5.49**	**0.002**

Lastly, but most certainly not least, is that weaning stress is often due to a multitude of issues. Their commonality and cumulative effect is that they produce stress. Some of these factors are:

- inadequate starter intake before weaning due to too much milk/MR being fed with inadequate time for adequate starter intake and rumen development
- moving calves right after weaning rather than allowing 1-2 weeks after weaning before moving
- moving calves into a large group rather than only 6-8 calves per initial grouping for another month of transition
- too many other changes right after weaning such as vaccinations, dehorning, castration
- feeding too much forage initially fostering gut fill and reducing intake and true body weight gain
- inadequate drinking water locations or poor quality water

These stressful factors often result in a respiratory problem which can impair a calf for life.

The Bottom Line

Don't overlook the weaning transition period--2 weeks before and 2 weeks after full weaning. Feed a good quality starter, preferably well-texturized, and have at least 2 full weeks of about 2 lb daily average daily intake. That may require stepping down high levels of milk/MR feeding over a 3-week period to get better starter intake before full weaning. Minimize number and magnitude of changes at and after weaning to reduce stress.

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