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Ad libitum milk feeding may yield larger calf bodyweight gains

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Calves left with their dam undoubtedly consume more milk than if bucket fed under a limited feeding program. However, it then is difficult to measure how much calves consume when having unlimited access to the cow.

It would be helpful if a more convenient practice could be followed experimentally in which calves had unlimited access to milk without the cow in the picture and individual daily intakes could be measured. Jasper and Weary (2002) did just that.

Female Holstein calves from the University of British Columbia research herd were separated from their mothers within two hours of birth, weighed, moved into individual pens and fed four liters of colostrum over two feedings. Twenty-eight calves were alternately assigned to two treatments and housed in individual pens interspersed evenly throughout the barn. Pens had solid wooden sides, with the rear and front of the pens open for free access to a barley-based starter (87.1% dry matter, 21.6% crude protein), chopped fescue hay (80.4% dry matter, 18.7% crude protein) and water from a bowl drinker.

Bodyweights at birth were similar for conventionally and *ad libitum*-fed calves at 92.5 ± 2.0 and 94.5 ± 2.2 lb., respectively. Calf birth weight was used as the covariate in the analysis of covariance for treatment effects.

All calves were fed whole milk, including milk from fresh and treated cows, but nutrient content was not reported. Conventional calves were fed milk from open, 5 L plastic buckets twice daily at 8 a.m. and 5 p.m. The amount of milk fed was adjusted individually to 10% of bodyweight. All calves were weighed twice weekly and on the day after weaning (day 43).

Ad libitum calves were individually allowed continuous access to milk via a nipple connected with a one-way valve to a 23 L bucket replenished twice daily, and the entire system was cleaned daily.

Both treatments were gradually weaned beginning on the evening of day 37 by diluting the milk with water

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TABLES

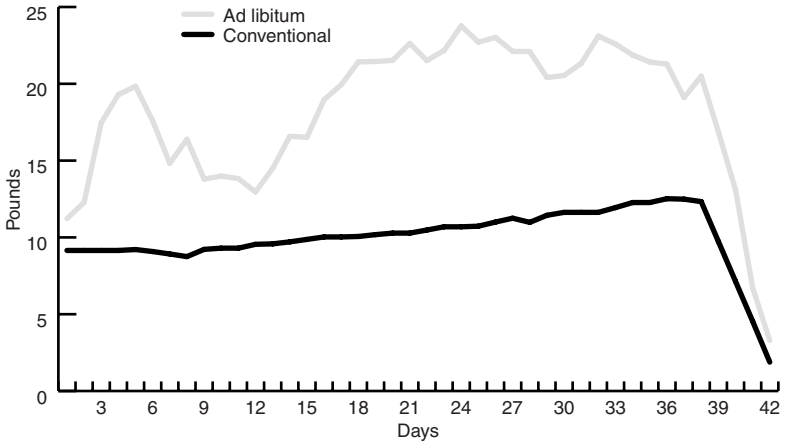
1. Energy and ADP allowable daily gains (lb.) for both conventional and *ad libitum* milk intakes at midweeks prior to weaning

Days	Bodyweight	Milk	Energy	ADP	Actual
Conventional					
3-4	93	9.2	0.95	0.90	0.41
10-11	97	9.4	0.94	0.92	0.48
17-18	103	10.1	1.01	0.99	1.16
24-25	113	10.9	1.05	1.07	1.35
31-32	123	11.7	1.09	1.15	1.79
Ad libitum					
3-4	102	19.6	2.70	2.17	1.79
10-11	108	13.4	1.57	1.39	0.56
17-18	118	21.4	2.78	2.37	1.97
24-25	133	22.9	2.80	2.52	2.19
31-32	149	22.9	2.62	2.49	2.02

2. Overall intakes and bodyweight gains (lb.) for conventional and *ad libitum* milk-fed calves during preweaning (days 0-36), weaning (days 37-42) and postweaning (days 43-63) phases

	-----Preweaning-----		-------Weaning-------		----Postweaning----	
	Conv.	*Ad lib.*	Conv.	*Ad lib.*	Conv.	*Ad lib.*
Bodyweight	129.9	153.0	138.1	158.8	178.6	196.2
Daily gain	1.06	1.72	1.16	0.79	1.87	1.50
Milk intake	10.8	19.4	6.0	0.80	—	—
Starter intake	0.37	0.20	1.94	1.48	4.16	4.07
Hay intake	0.07	0.02	0.26	0.18	0.26	0.20

FIGURE



1. Daily milk consumption by calves on conventional and *ad libitum* feeding programs.

by 10% of the total volume. Amount of water increased 10% of the total volume at each feeding so that on the morning of day 42, calves received 100% water. However, all calves continued to receive water from their respective milk feeding system until day 56 in addition to water from the bowl drinker. Milk intake was measured daily, while bodyweights and starter and hay consumptions were measured twice weekly.

Conventional calves' milk intake (Figure 1) progressively increased 35% from day 1 to 36 — just prior to the start of the weaning process. In contrast, *ad libitum* calves consumed a total of 696 lb. versus 388 lb. of milk for conventional calves, but the pattern of milk intake for *ad libitum* calves was striking, with a rapid peak during the first week, followed by a decline until near the end of the second week and then a plateau of nearly 22 lb. from day 17 to 35 — right before the weaning process.

Using the 2001 National Research Council's (NRC) calf model, Table 1 was constructed with preweaning midweek reference points for bodyweight, milk intake and both energy and apparent digestible protein (ADP) allowable daily gains. (All individual and extensive data were provided for this analysis by co-author Dan Weary.) Whole milk in the NRC calf model contained 12.5% dry matter, 30.8% fat and 25.4% crude protein.

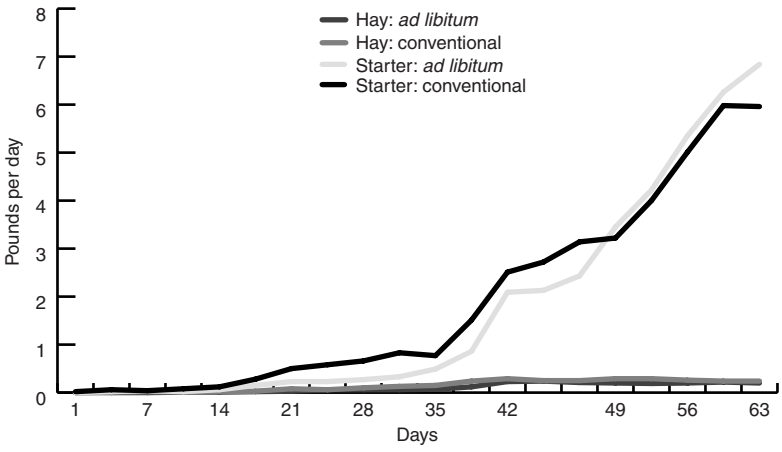
Actual daily gains for conventional calves were about one-half energy and ADP allowable gains during the first two weeks. This indicates that the calf model over-predicts gain in the first several weeks. Higher gains than predicted during the last three weeks would be at least partially due to starter intake contributing more nutrition. Both energy and ADP allowable daily gains were similar to each other for the conventionally fed calves.

In contrast, actual daily gains for the *ad libitum* calves were lower than allowable daily gains during week 1, and for the last three weeks, ADP allowable gains were lower than energy allowable gains throughout, but actual daily gain was much lower than allowable daily gains during the second week when milk intake dropped so much (Figure 1).

Assuming intakes are correct and composition of milk fed was similar to NRC milk composition, this indicates that the calf model over-predicts daily gains at higher daily gains, and it over-predicts more on the basis of energy than protein.

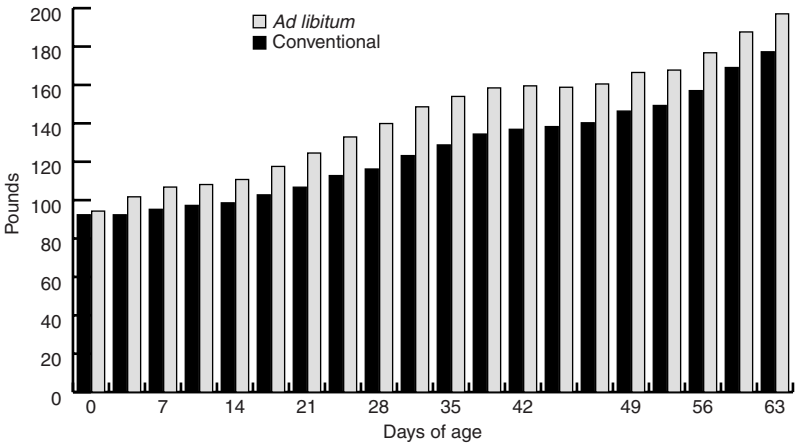
Hay intakes were nearly inconsequential, while starter intake followed a similar pattern for both treatments but with *ad libitum* calves lagging behind conventional calves until after weaning, most likely due to greater nutrient contributions from *ad libitum* milk intakes (Figure 2).

FIGURE



2. Daily intake of starter and hay on conventional and *ad libitum* feeding programs.

FIGURE



3. Bodyweight change of calves fed milk conventionally or *ad libitum*.

Bodyweight gain differences between treatments were similar across weeks, being somewhat lower in the first two weeks but increasing during middle weeks prior to a weaning downturn. This latter picture indicates the critical period around weaning (Kertz, 2002).

The high fat level and fat-to-protein ratio in whole milk makes the weaning process more problematic as starter intake would be limited (Kuehn et al., 1994). For instance, during the week prior to weaning, conventional calves gained 1.16 lb. per day (versus 1.79 the week before) with a starter intake of 1.5 lb. at midweek. This compared to 1.52 lb. of gain per day the week after weaning with a midweek starter intake of 3.14 lb.

Ad libitum calves gained 0.79 lb. per day the week prior to weaning (versus 2.02 lb. the week before) with a starter intake of 0.86 lb. at midweek. This compared to 1 lb. of gain per day the week after weaning with a midweek starter intake of 2.43 lb.

Intakes and performance (Table 2) between treatments were different ($P < 0.01$ or 0.001) during the preweaning phase; only bodyweight and milk intake were different ($P < 0.01$) during the weaning phase, and only bodyweight differed ($P < 0.05$) during the postweaning phase.

Thus, the differences during the preweaning phase did carry over into greater bodyweights at the end of the 63-day study.

The Bottom Line

Ad libitum milk intake compared to conventional milk feeding (10% of bodyweight) resulted in greater bodyweight gains during the preweaning phase, and this resulted in greater bodyweight at the end of the 63-day period. However, performance around weaning was affected in both treatments and more so with *ad libitum* milk feeding.

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