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Additional factors suggested in analysis of study results

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In our current dairy production systems, calves are managed quite differently than the natural cow-calf situation. This leads to a number of issues. Among these are what is possible scientifically, what producers are willing and able to do, the economics and return of a particular system and the specific goals and objectives of a calf/heifer system.

In that light, a study will be scrutinized that used a high level of milk feeding approach for female Holstein calves. There are a number of other factors involving the dam when this practice is followed (Krohn, 2001), but that is beyond the objective of this column.

A frequently cited study of high-level milk feeding is Bar-Peled et al. (1997), which was conducted beginning in February and into May 1991. All calves were separated from their dams, weighed and randomly assigned to control or treatment blocks on the basis of bodyweight at birth (average 84 lb.) and birth date within six hours after birth.

The description of colostrum feeding is confusing and incomplete. "All calves were bottle-fed 2 liters of colostrum from the dam. The (control calves) were bottle-fed 2 liters of warm colostrum (37°C) twice, once on day 3 and once on day 4. The control calves were fed 1.5 liters of warm colostrum in open buckets at 0800 and 1600 hours." Was there only 2 liters of colostrum fed during each of days 1 and 2 and then 2 liters fed twice daily during days 3 and 4? If so, what does the feeding of 1.5 liters at 0800 and 1600 hours refer to?

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TABLES

1. Performance until conception

	Control calves	Treatment calves
Milk replacer milk intake, lb./6 weeks	333	1,563
Feed intake, lb./6 weeks	62	0
Bodyweight, lb. at 6 weeks	136	162
Daily gain, lb. per day/6 weeks	1.24**	1.87**
Bodyweight, lb. at 12 weeks	216	194
Daily gain, lb. per day/12 weeks	1.89*	0.77*
Bodyweight, lb. at conception	720	790
Daily gain, lb. per day/>12 weeks	1.41*	1.92*

**P < 0.01.
*P < 0.05.

2. Calving and first-lactation data

	Control calves	Treatment calves
Calving age, days	700*	669*
Bodyweight at calving, lb.	1,116	1,198
Daily gain from conception, lb.	1.43	1.48
Wither height, in.	52.9*	55.0*
Milk, lb./300 days	20,195	21,192
Milk fat, lb./300 days	602	592
Milk protein, lb./300 days	574	567

*P < 0.05.

Was this in addition to the bottle-feeding of colostrum for each of the four days? Otherwise, these calves would have been short on colostrum feeding for both antibody protection and nutrition.

From days 5 to 9, control calves were then fed 1.5 liters of a 23% protein/15% fat milk replacer that had 4.6% protein and 3.0% fat on a liquid basis. Again, it appears that only 1.5 liters of milk replacer were fed total for each day. From days 10 to 14, the control calves were fed 2 liters of milk replacer, and from days 15 to 50, they were fed 3 liters of milk replacer once daily.

In contrast, treatment calves were paired, and each pair suckled the same dam three times daily for 15 minutes every eight hours. This treatment continued until day 43 when these calves were removed from their dam. However, until day 50, treatment calves were fed 4 liters of the milk replacer; and then from day 51 until 60, they were still fed 2 liters of milk replacer daily with weaning at age 60 days.

Thus, there was great disparity in level of nutrition with the control calves being fed a sub-par nutritional diet because of low level of colostrum and milk replacer feeding, while treatment calves had *ad libitum* nursing for 45 minutes per day followed by further milk replacer feeding until 60 days after weaning from the dam.

Both groups also had access to a feed mixture, but it contained 7.5% poultry litter, 34.5% wheat straw and 7.5% of either wheat or corn silage with a crude protein content of 13% — hardly an appetizing mixture, which also would retard rumen development at this age with the high level of poor-quality roughage, and would be too low in protein. Both groups also had available free choice vetch hay and water. Both control and treatment calves were each housed as a group, except during nursing for the treatment group.

Milk intake for treatment was measured by weighing calves before and after nursing at each nursing one day per week. Intakes and performance are shown in Table 1.

The authors calculated that overall energy intake (no energy system indicated) until 42 days of age was 397 Mcal for control calves and 452 Mcal for treatment. The disparity in protein intake (my calculation with what was available in this report) was even greater with 22.2 lb. of protein for control calves and 51.3 lb. for treatment calves.

It is surprising that bodyweights at six weeks were not even more stunted for control calves; but it is also likely that fat deposition was greater since the energy-to-protein ratio for control calves was 39.3 versus 19.4 for treatment calves. Interestingly, after weaning at 12 weeks of age, the daily gain of control calves increased to the rate treatment had been during the first six weeks, while treatment group's daily gain decreased more than 1 lb. compared to what it had been during the first six weeks. This was most likely due to the stress of weaning and the lack of a good transition program (Kertz, 2002).

Krohn (2001) also recognized this problem in stating "A high daily gain obtained through a high milk intake is not necessarily beneficial because it results in a decreased intake of roughage and hence delayed rumen development, and increases the difficulties associated with weaning-separation." Actually, it is the roughage intake, due to the high level of poor-quality roughage in the starter feed, at this early age that would have retarded rumen development.

From 51 days of age until first calving, both groups of calves were maintained under the same management conditions. The feed mixture contained 12% vetch hay, 8% whole cottonseeds and 80% concentrate mix resulting in a 16% crude protein mix that was much better than the treatment group had been fed before 51 days of age. The poor start this group received may have been a factor in why they gained less from 12 weeks of age until conception.

Parameters at calving and for the first lactation are shown in Table 2.

No breeding criteria were provided other than that heifers were observed for estrus three times daily starting at eight months of age. However, calving at 22 months for the treatment group versus 23 months of age for control calves was lower. There was a similar trend for bodyweight, but the lower daily gain for both groups indicates why desired precalving bodyweights of 1,350-1,400 lb. at 24 months of age were not achieved. Even if 0.4 lb. more daily gain was achieved, that would have only added about 100 lb. to bodyweight but would still be about 150-200 lb. short of the first-calf heifer objective.

Of greater significance is the lower wither height of control calves versus treatment first-calf heifers. This is not too surprising because control calves were short of dietary protein (and energy too if protein intake had been adequate) as noted before. This occurred during the time period when the greatest increase in wither height occurs (Kertz et al., 1997).

Thus, these control heifers did not realize their growth potential (no starting or interim wither height measurements were provided in this study). The authors assumed that this occurred due to the greater nutrition afforded by the high-level milk feeding program, but it can be argued at least equally that it was due to a nutritionally deficient control feeding program.

Milk production was higher ($P = 0.08$) for treatment heifers, but fat and protein production were similar. Since these components were numerically higher but similar between control and treatment heifers, the percentage of fat (2.98 versus 2.79) and protein (2.84 versus 2.67) were slightly higher for control heifers. Days open and conception rate also did not differ between treatments.

The authors concluded "Treatment calves had higher (average daily gain) and greater height at the withers and tended to have higher milk production than did calves fed milk replacer." However, as we have seen, the real limitation appears to be the low feeding rate of the milk replacer and the poor starter feed resulting in low protein intake and lower wither height increase during the formative period of the first two months of life.

The Bottom Line

In this study of high access to cows' milk during the first two months of life, there appeared to be an advantage at six weeks of age and at/during first lactation relative to feeding milk replacer. However, the level of milk replacer feeding was low, and a poor starter feed was provided resulting in deficient nutrient intake for control calves and lower wither height at calving; this may well have occurred during the first two months.

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