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Data comparing calf growth of Holstein, Jersey breeds rare

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Calf data on Jerseys are limited. Published data on both Holstein and Jersey calves in the same study are even more rare.

A recent article (Stanley et al., 2002) assessed the influence of milk replacer feeding frequency on weight gain, starter intake and glucose metabolism. This study provided an opportunity to review a number of parameters for growth of both young Holstein and Jersey calves, albeit at two locations.

In the first experiment, 18 Holstein calves were born and raised between October 1999 and June 2000 at the Louisiana State University research farm in Baton Rouge, La., while the second experiment used 15 Jersey calves born and raised between January and July 2000 at the Hill Farm Research Station in Homer, La. There was a difference in protocol during the first three days for these two experiments.

In experiment 1, Holstein calves were removed from their dams, weighed and placed in individual hutches within 12 hours of birth. Calves received 1.9 l of colostrum at each of the first two feedings and were trained to drink milk from buckets during the first three days of life. Refused colostrum was fed via esophageal feeding tubes.

In experiment 2, Jersey calves were allowed to suckle their dams during the first 24 hours of life. Calves were weighed and then placed in individual calf hutches on day 2 and were fed milk replacer from nipple pails. Thus, it appears that the Jersey calves did not have the same administration of colostrum as did the Holstein calves.

TABLE

Least square means for starter intake and birth weights[a] of calves fed milk replacer 1X or 2X daily

	Holstein			Jersey		
	2X	1X	%CV	2X	1X	%CV
Birth weight, lb.	86.1	78.4	9.6	53.9	59.0	15.5
Weaning weight, lb.	114.1	116.7	9.3	72.9	68.5	15.9
Daily gain, lb.	0.67	0.91	—	0.45	0.23	—
Ending weight, lb.	139.8	140.7	7.6	82.4	81.0	13.7
Daily gain, lb.	1.84	1.71	—	0.68	0.89	—
Starter intake, lb./day	1.73	1.65	23.3	1.15	1.12	39.3
Starter, % of bodyweight	1.36	1.44	20.6	1.56	1.53	27.5

[a]Birth weights are unadjusted means while weaning and end of trial weights are covariant adjusted to compensate for differences in birth weight.

In both experiments, calves were fed twice daily during the first week of life the same 22% protein/15% fat milk replacer with 220 g oxytetraclycine/485 g neomycin base per ton. This milk replacer fat level would minimize the decreased starter intake effect noted with fat level beyond 15% (Kuehn et al., 1994).

Milk replacer was reconstituted to 15% dry matter and fed in two equal feedings at 10% of initial bodyweight. Calves were also offered a commercial calf starter (18% protein as-fed, texturized) twice daily for *ad libitum* consumption up to a limit of 5.8 lb. per day. Water was offered free-choice daily.

In both experiments, calves were divided into two treatments with treatment 1 fed milk replacer twice daily (2X) and treatment 2 fed the same quantity of milk replacer powder but in one feeding daily (1X). However, the amount of water used to reconstitute milk replacer for calves fed 1X was reduced 30%, providing a final dry matter of 21.4% as compared to 15.0% for calves fed 2X. All calves were abruptly weaned at six weeks of age.

Blood was collected weekly except for week 7, and urine sampled along with blood during the glucose tolerance test performed during weeks 3 and 6 in all calves. Performance data are provided in the Table.

Discussion

There were no statistically significant differences ($P < 0.10$) within breed for performance data. Birth weight tended ($P = 0.06$) to be higher for Holstein calves fed milk replacer 1X, but after weights were covariant adjusted, there were no significant treatment differences in weaning or end-of-trial bodyweights for calves fed 1X or 2X in either experiment.

Calculated average daily gains before weaning appeared to be greater for Holsteins fed 1X versus 2X and for Jerseys fed 2X versus 1X, but the opposite pattern existed after weaning for both breeds. This may be a function of the more limited number of calves so that numerically different birth weights did not result in statistically significant performance differences (Kertz, 2003).

On the other hand, measuring glucose metabolism was a major objective of this study. The protocol for sampling blood and urine and measuring glucose tolerance required much more labor and a large number of laboratory analyses — these are limiting and costly factors for this type of study precluding a larger number of calves as for a performance study (the authors are to be commended for undertaking such a demanding study as this).

Note also that Jerseys had greater variability in their performance data than Holsteins based on the percent

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coefficient of variation (CV) calculated. This is partly a function of Jersey data being smaller numbers than comparable Holstein data. Remember that Jerseys also did not have the same controlled colostrum program that the Holsteins did.

How does performance of calves in this study compare to nutrient requirements in the most recent National Research Council publication (NRC, 2001)? The composition and the amount of milk replacer fed would alone have met the average protein and metabolizable energy requirements during the six-week period prior to weaning for both Holsteins and Jerseys. That is because the feeding rate of milk replacer was nearly 1.5 lb. for Holsteins and nearly 1.0 lb. for Jerseys. Starter intake (provided by Dr. Cathy Williams) provided 40-50% more protein and energy as compared to milk replacer intake. Yet, the daily gains were as indicated by the NRC for calves fed milk replacer alone. This would indicate that the NRC in its Table 10-2 underestimated protein and energy requirements for these calves.

Post-weaning protein, energy and starter intake were mostly in agreement with NRC requirements in Table 10-4. However, requirements in this table did not cover bodyweights of Jerseys in this study. When these actual data were used in the NRC Young Calf Model, they did match up closely for energy and starter intake.

However, protein intake exceeded requirements in this case, as well as for all treatments and periods for both Jerseys and Holsteins in this study — raising further questions regarding the current obsession to feed starters exceeding 16% protein on an as-fed basis. That protein level would have met NRC requirements throughout this study.

A summation of metabolite data in this study follows:

• Urinary and plasma glucose and plasma nonesterified fatty acids (NEFA), insulin and glucagon concentrations were not significantly different due to milk replacer feeding frequency. Most calves had nondetectable concentrations of urinary glucose.

• Plasma glucose concentrations were numerically higher in Holstein compared to Jersey calves, but NEFA concentrations were numerically greater in Jersey than in Holstein calves. Plasma insulin and glucagon were similar for the two breeds.

• Jersey calves had an interaction ($P < 0.05$) of sampling time and milk replacer feeding frequency and week for plasma NEFA concentrations. This may be related to Jersey starter intake being a larger percentage of bodyweight even though their absolute starter intake was lower than Holsteins.

• By three weeks of age, as calves began to eat more starter, pre- and post-feeding plasma NEFAs became similar, whereas prior to this time, pre-feeding plasma NEFAs were greater than post-feeding concentrations.

• There was an interaction of week and sampling time ($P < 0.05$) for plasma glucose concentrations in Holstein and Jersey calves. When weaning occurred, plasma glucose concentrations became similar among all six sampling times. There was also a progressive decrease in plasma glucose with age in all calves regardless of milk replacer feeding frequency.

• There was an interaction of week and sampling time ($P < 0.05$) for plasma insulin concentrations in Holstein and Jersey calves, but insulin peaked at 60 minutes post-feeding for Holsteins and at 120 minutes for Jersey calves.

• Plasma glucagon increased in both breeds as calves began eating starter throughout the day, reflecting less dependence on the milk replacer as the primary source of nutrients. This probably reflected increased hepatic gluconeogenesis from volatile fatty acid production and absorption as a consequence of increased starter intake and rumen development.

• Acute insulin response was greater ($P < 0.05$) for calves fed milk replacer 2X than 1X. It also appeared that Jersey calves may be more insulin sensitive as evidenced by the large numerical difference in insulin sensitivity between experiments 1 and 2.

Thus, milk replacer feeding frequency had little performance or glucose metabolism effects.

The Bottom Line

The 2001 NRC requirements appeared to match closely for some aspects of this study, but higher protein and energy intakes than NRC requirements for performance of pre-weaned calves along with excessive protein intake compared to requirements, both before and after weaning, raise questions about these requirements without lending any credence for higher protein calf starters.

There may also be some metabolic differences between Holsteins and Jerseys. However, the same interaction of milk replacer and calf starter on performance was evident in both breeds.

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