Leave No Dairy Calf Behind

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The Dairy Calf and Heifer Association (DCHA, www.calfandheifer.org) has established several "Gold Performance Standards" to serve as benchmarks for any dairy operation that is raising replacement dairy calves. These standards focus on six main parameters: mortality, morbidity, colostrum management, nutrition, growth rate, and housing. Each of these are important and contribute to the overall goals of rearing calves as economically as possible, that can be bred at an earlier age, thus reducing the age at first calving and that can potentially remain in the herd longer and produce more milk.

Mortality and Morbidity

Mortality refers to an animal that survives the first 24 hours of life but dies after that. Calves that fail to survive the first 24 hours or are dead on arrival are considered stillborn. Morbidity refers to any "sick" calves that require treatment but survive. They could suffer from neonatal diarrhea (scours), respiratory disease (usually pneumonia) or something else; pinkeye, bloat, acidosis, heel warts, hardware, etc. Any operation that has mortality and or morbidity rates exceeding those listed below (Table 1) should re-evaluate their calf and heifer rearing practices.

Table1. DCHA Gold Standard benchmarks for a well-managed Heifer rearing enterprise.

	Mortality	Scours	Pneumonia	Other	ADG
24 hr to 60 days of age	<5%	<25%	<10%		2X birth wt.
61 to 120 days of age	<2%	<2%	<15%		2.2 lb/day
121-180 days of age	<1%	<1%	<2%		2.0 lb/day
6 mo to 1 yr.	<1%		<3%	<4%	
1 yr. to fresh	<0.5%		<1%	<2%	

Colostrum Management

The importance of colostrum in reducing mortality and morbidity has been known for decades, but recent research has led to modifying some earlier, long-held concepts. One way to summarize the key issues related to colostrum management is to focus on the four "Q's:

Quality	colostrum should contain > 50 g/L IgG
Quantity	initial feeding of 10-15% of birth weight (90 lb calf should receive 4 qts)
Quickly	initial feeding within first 2-4 hr of life
Cleanliness	(s**Q**ueaky clean for 4th Q) should contain <100,000 cfu/ml total plate count

If these standards are followed, calves that are 2-7 days old should have blood serum total protein levels > 5.2 g/dL or serum IgG levels > 10.0 g/L (some evidence to target > 12 g/L). Anything below these levels would be considered to be a failure of passive transfer (FTP). In fact, each 1% increase in IgG > 12 mg/mL means 18 lb more milk per lactation. Several research studies conducted since 1992 have documented increased mortality & morbidity, decreased calf growth rates, increased culling during first lactation, and decreased milk production in 1st & 2nd lactation in calves with FTP.

Dairy producers in general still have a lot of room to improve their colostrum management as evidenced by a recent study (Morrill et al., 2012). This study involved collecting samples of colostrum from dairy farms across the US and evaluating IgG concentrations and total plate count (bacterial contamination).

It is encouraging that over 60% of the individual colostrum samples contained over 50 mg/mL of IgG, but nearly 30% had less than 50 g/L. Colostrum with < 50 g/L of IgG would not provide an adequate amount of protection if fed to a newborn dairy calf, even if fed within 1 hour of birth.

Less encouraging is the fact that only slightly over half of the samples collected were "clean" from a bacterial standpoint, that is contained less than 100,000 CFU/mL, with >25% of the samples containing > 500,000 CFU/mL. These samples represent a very high level of contamination and may present an overload of bacteria in the gut if fed to a newborn calf. Absorption of IgG is decreased when bacterial loads of colostrum is high. This underscores the importance of employing the same rigid standards of cleanliness and sanitation when obtaining colostrum from a recently fresh cow. The same practices that contribute to low SCCs also are important in maintaining a low bacterial load in colostrum, namely proper cleaning and sanitizing the udder and teats before milking the cow and making sure that the utensils and equipment have been properly cleaned and sanitized as well.

The good news from this study is that slightly over half (53.7%) of the samples collected in the Midwest, but less than 40% of all samples, contained an adequate concentration of IgG (> 50 mg/mL) and were "clean" (< 100,000 CFU/mL) (Table 2). However, nearly 10% of the samples (8.5%) failed to meet both standards. The best thing to do with this colostrum would be to discard it completely as it will not provide sufficient protection for the calf and can actually do more harm than good if fed to a newborn dairy calf as the first colostrum the calf receives following birth.

Table 2. Percentage of samples meeting one or both quality standards

		Overall		Midwest	
IgG	TPC	No.	%	No.	%
>50 mg/ml	<100,000 cfu/ml	294	39.4	88	53.7
>50 mg/ml	>100,000 cfu/ml	233	31.2	51	31.1
<50 mg/ml	>100,000 cfu/ml	104	14.0	14	8.5
<50 mg/ml	<100,000 cuf/ml	115	15.4	11	6.7
Total		746	100.0	164	100.0

Colostrum samples were also summarized for both IgG concentration and cleanliness, based whether they were fresh when collected, or after being frozen or refrigerated. Information was not obtained regarding operating temperature of the refrigerator or freezer, length of storage, or how frozen samples were thawed. Storage method has a significant impact on bacterial contamination (Table 3). Consequently, a much smaller percentage of the refrigerated (18.5% for refrigerated vs. > 40% for fresh or frozen samples) samples met both IgG and TPC standards.

Table 3. Percentage of samples based on cleanliness

TPC	Fresh		Refrigerated		Frozen	
<100,000 cfu/ml	122	67.0	35	23.0	252	61.2
100,000-300,000	21	11.5	17	11.2	52	12.6
300,000-500,000	9	5.0	10	6.6	28	6.8
500,000-1,000,000	8	4.4	32	21.0	34	8.2
>1,000,000	22	12.1	58	38.2	46	11.2
Total	182	100.0	152	100.0	412	100.0

Nutrition

Some recent studies have looked at the impact of feeding much higher quantities of colostrum in the first feeding following birth than the long-standing traditional amounts. In the first study (Table 4), Brown Swiss calves were fed either 2L or 4L in the initial feeding (Faber et al., 2005) with calves receiving the higher level of colostrum having a higher rate of bodyweight gain and subsequently producing more milk in their first two lactations.

The second study looked at the effect of both the initial (2 or 4L) feeding of colostrum and subsequent feeding levels of milk replacer (4 or 12 L/day) in an auto feeder (Soberon & Van Amburgh, 2011). Calves fed the higher initial level of colostrum had a greater average daily gain (0.78 kg/d vs. 0.55 kg/d) post weaning and a greater feed efficiency (0.38 vs. 0.32 kg gain /kg DMI) than calves fed less colostrum.

Table 4. Rate of gain, survival and milk yield of Brown Swiss calves fed two levels of colostrum in the initial feeding after birth.

Colostrum fed	2L	4L
Number of calves	37	31
ADG, lb/d	1.76	2.20
Age @ conception, mo.	14.0	13.5
Survival thru 2 lactations	75.3%	87.1%
Milk, two lactations, lb.	35,297	37,558

Table 5. Milk production differences among treatments where calves were allowed to consume approximately 50% more nutrients than the standard feeding rate prior to weaning from liquid feed.

Study	Milk yield, lb
Foldager and Krohn, 1994	3,092
Bar-Peled et al., 1997	998
Foldager et al., 1997	1,143
Ballard et al., 2005 (@200DIM)	1,543
Shamay et al., 2005 (post-weaning protein)	2,162
Rincker et al., 2011 (proj. 305@ 150 DIM)	917
Drackley et al., 2007	1,841
Raeth-Knight et al., 2009	1,800
Morrison et al., 2009 (no diff in calf growth)	0
Moallem et al., 2010	1,600
Soberon et al., 2011	1,700

Several additional studies examined the effect of feeding more total nutrients prior to weaning and looking at the impact on milk yield once the animals calved. These studies are summarized in Table 5, with all but one showing increased milk yield from feeding a higher plane of nutrition pre-weaning, and one study showing no difference.

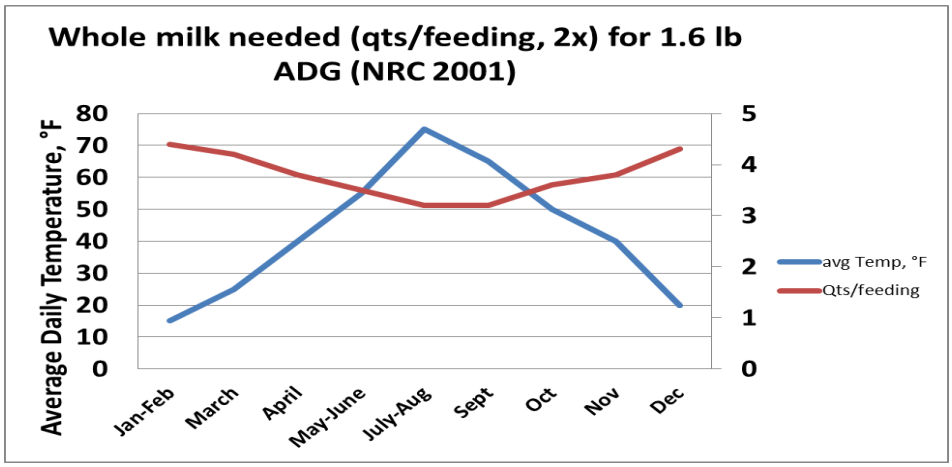
Table 6. Estimated average daily gain (ADG) for 100 lb. calf fed whole milk or a 20-20 (%CP-%Fat) milk replacer

Diet Source	Gain Predicted from Energy	Gain Predicted from Protein
Milk Replacer, 1lb/day	0.39 lb. ADG	0.52 lb. ADG
Whole Milk, 1 gal/day	1.15 lb. ADG	0.91 lb. ADG
Milk Replacer, 1.5 lb/day	0.78 lb. ADG	0.84 lb. ADG
Whole milk, 1.5 gal/day	1.62 lb. ADG	1.38 lb. ADG

Another way at looking at the potential benefits from feeding a higher plane of nutrition is to look at average daily gain (ADG) (Table 6). Increasing the amount of whole milk fed daily from 1.0 gal. to 1.5 gal. will provide almost enough additional energy and protein to support an additional 0.5 lb gain/day.

The increase is not as dramatic if feeding a 20:20 milk replacer, with the additional 0.5 lb. of DM providing enough energy to support an additional 0.39 lb. of gain, but only enough protein for 0.32 lb. of gain. Thus, when feeding milk replacers, protein becomes the first nutrient limiting ADG.

There are a wide range of calf milk replacers available on the market with most ranging from 20% to 26% crude protein and 10% to 25% fat. One question often asked by producers is "Are the milk replacers with higher crude protein and higher fat levels worth the additional cost?" Given the increased ADGs and the additional milk production levels achieved, the answer is a resounding "yes".



Often overlooked is the impact of cold weather on ADG. The figure to the right illustrates the amount of whole milk needed at various ambient temperatures to support 1.6 lb. ADG. Six quarts daily is enough for calves during the hot summer months, but at least 8 quarts are needed to achieve the same ADG when temperatures dip below freezing.

Housing

Age of heifer	Space per animal	Freestall size	Bunk Space
24 hrs to 60 days of age	Min. of 34 sq. ft. per animal if group housed or sized so calf can turn around in individual pens	Not recommended	Adequate space for all animals to eat at the same time
61-120 days	Min. of 34 sq. ft. per animal	Not recommended	Adequate space for all animals to eat at the same time
121-180 days	Min. of 40 sq. ft. or one free stall per animal	6-9 months: 30x54 inches	Adequate space for all animals to eat at the same time
6-12 mos.	45 sq. ft. per head, or one free stall per animal	9-12 months: 34x60 inches	18 inches per head
12-18 mos.	50 sq. ft per heard, or one free stall per animal	36x69 inches	20 inches per head
18 mos. to 2-4 weeks pre-freshening	60 sq. ft. per head, or one free stall per animal	40x84 inches	24 inches per head
2-4 weeks pre-freshening	100 sq. ft per head, or one free stall per animal	43x96 inches	30 inches per head

Growth rates

Holstein heifers should weigh between 825 and 900 lbs. (or 55% of mature cows in herd) by the time they are 13-15 mos. of age. They need to average between 1.7 and 2.0 lb. ADG from birth to 13-15 mo. of age in order to achieve this weight at the age when they should be bred. Stature is easier to measure on most dairy farms, consequently heifers should be at least 50 in. at the hip and at least 48 in. at the withers by the time they are 13 mos. old. If they continue to grow properly, they should reach a pre-calving weight around 1,350 lb. (85% of pregnant mature cows in the herd).