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2001 NRC recommendations for dairy calves appear to be in line

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The 2001 National Research Council (NRC) document on *Nutrient Requirements of Dairy Cattle* contains a 20-page section on the nutrient requirements of the young calf, whereas the 1989 NRC did not have a separate calf section. This section is a most welcome and beneficial addition to the 2001 Dairy NRC. For those interested in an even more thorough discussion and reference on this subject, refer to: The Development, Nutrition and Management of the Young Calf by C.L. Davis and J.K. Drackley, Iowa State University Press, Ames, 1998.

In the 1989 NRC, no requirements were given between weaning at 165 lb. and up to 220 lb. for either small- or large-breed females. Prior to weaning for calves fed a mix of milk or milk replacer and calf starter, 1989 energy requirements were 67-84% higher for large and small breeds compared to the 2001 NRC. In the 2001 NRC, it is realistic to consider that preweaned bodyweights of 66-99 lb. apply to small breeds and 99-132 lb. apply to large-breed females.

Energy

Table 1 is abridged from Table 10-2 of the 2001 NRC for calves fed milk replacer plus starter. It assumes the milk replacer contained 2.16 Mcal metabolizable energy (ME)/lb. dry matter (DM) and the starter contained 1.49 Mcal ME/lb. DM. It also assumes that the milk replacer provided 40% of DM for a composite 1.89 Mcal ME/lb. DM. Dry matter intake (DMI) was the total necessary to meet ME requirements and was not intended to predict voluntary intake. The efficiency of conversion of digestible energy (DE) to ME was assumed to be 0.96 for milk replacer, 0.88 for starter and 0.934 for the combination.

Note that as daily gain increased with increasing bodyweight, DMI and energy intake increased at an increasing rate because of a greater maintenance requirement with greater bodyweight. So, the younger the calf, the more efficient it is at converting energy and nutrients into bodyweight. This principle must be kept in mind for it translates into lower costs per unit of bodyweight increase at an early age even though the feedstuffs may cost more per pound or ton (Kertz et al., 1998).

How do the above requirements compare to actual data? Using the three-year database for calves raised inside a research facility (Kertz et al., 1979) and considering bodyweight, DMI and daily gains for each week prior to weaning, calculated ME intakes were very close to the requirements shown in the table.

A similar abridged table (Table 2) from Table 10-4 in the 2001 NRC was prepared for weaned calves. Bodyweights from 110 to 176 lb. for calves gaining 0.88-1.75 lb. per day apply to small-breed females and from 132 to 220 lb. for calves gaining 1.32-1.98 lb. per day apply to large-breed females.

In the database (Kertz et al., 1979), calves were weaned at one month of age. This is atypical based on National Animal Health Monitoring System data reported in a previous column (*Feedstuffs,* Sept. 10). This makes interpretation of these requirements a bit more complicated. For instance, using bodyweight and DMI data I am familiar with for the month following early weaning, the above requirements are too high in total energy intake and corresponding DMI for the first half of the month but too low in total energy intake and corresponding DMI for the last half of the month.

Recall that the NRC DMIs are not intended to predict voluntary intake but simply meet energy requirements at the stated energy concentration in the calf starter and taking into account the specific bodyweight and daily gain. Weaning at a later age or using a higher-fat milk replacer or whole milk will also affect these parameters because the more energy coming in the liquid, the lower starter intake will be with some carryover, as noted by Kuehn et al. (1994). So, the applicability of these requirements may vary.

TABLE

1. Daily requirements of the preweaned young calf (abridged from NRC Table 10-2)

Bodyweight,lb.	Daily gain, lb.	DMI, lb.	ME ---Mcal per day---	DE	CP lb. per day
66	0.44	0.92	1.77	1.89	0.19
	0.88	1.10	2.33	2.49	0.31
77	0.44	1.03	1.96	2.09	0.19
	0.88	1.34	2.55	2.73	0.32
88	0.44	1.12	2.14	2.29	0.20
	0.88	1.45	2.76	2.95	0.33
	1.32	1.83	3.44	3.68	0.45
99	0.44	1.23	2.31	2.47	0.20
	0.88	1.56	2.96	3.16	0.33
	1.32	1.94	3.67	3.93	0.46
110	0.88	1.67	3.15	3.37	0.34
	1.32	2.07	3.89	4.17	0.47
	1.76	2.49	4.69	5.02	0.59
121	0.88	1.76	3.33	3.57	0.35
	1.32	2.18	4.10	4.39	0.47
	1.76	2.60	4.93	5.27	0.60
132	0.88	1.85	3.51	3.76	0.35
	1.32	2.29	4.31	4.61	0.48
	1.76	2.73	5.16	5.52	0.61

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Other features of this chapter are: a table summarizing the effect of environment on energy requirements of young calves; equations to calculate energy levels of milk, milk replacers and milk-derived ingredients, and typical nutrient compositions of milk replacers, a starter and a grower for young calves.

Protein

Similar to energy, crude protein (CP) requirements progressively increase with bodyweight and daily gains. Not surprisingly, if you calculate CP as a percentage of DMI, the numbers are in the lower 20s from Table 1 for preweaned calves, decrease somewhat with bodyweight and definitely decrease with lower daily gain. During the preweaned stage, there are also two sources of protein: the milk replacer and the starter. After weaning, the only dietary source is the starter.

In Table 10-4, CP as a percentage of DMI only significantly exceeds 18% once (not presented in Table 2). Remember, this and the values for a typical starter and a typical grower in the 2001 NRC are as a percentage of 100% DM. NRC is required to base its recommendations on published data. There are no published data since the 1989 NRC that would provide the basis for increasing the CP percentage in calf starters beyond 18% on a DM basis, which is roughly equivalent to 16% on an as-fed basis.

The most recent comprehensive study to evaluate the most appropriate CP percentage in a starter (Akayezu et al., 1994) concluded that "current NRC recommendations of 18% CP in the calf starter DM seem to be adequate for maximum growth of young calves. Calf starters containing higher amounts of protein offer no additional advantage, even when weaning occurs as early as four weeks of life …." Increasing the CP percentage beyond that point is also directionally incorrect for maximizing the efficiency of nitrogen utilization and minimizing nitrogen losses into the environment.

TABLE

2. Daily requirements of the weaned young calf (abridged from NRC Table 10-4)

Bodyweight,lb.	Daily gain, lb.	DMI, lb.	ME ---Mcal per day---	DE	CP lb. per day
110	0.88	2.49	3.51	3.92	0.44
	1.32	4.10	4.36	4.77	0.61
132	0.88	2.77	3.92	4.33	0.46
	1.32	3.43	4.83	5.23	0.63
	1.76	4.12	5.80	6.19	0.79
154	0.88	3.06	4.31	4.71	0.48
	1.32	3.74	5.26	5.66	0.64
	1.76	4.47	6.29	6.67	0.81
176	0.88	3.33	4.67	5.07	0.49
	1.32	4.03	5.68	6.07	0.66
	1.76	4.80	6.75	7.13	0.83
198	1.32	4.60	6.07	6.46	0.68
	1.76	5.46	7.19	7.57	0.85
	1.98	5.90	7.78	8.15	0.93
220	1.32	4.89	6.45	6.83	0.70
	1.76	5.79	7.67	7.99	0.86
	1.98	6.25	8.22	8.59	0.95

The Bottom Line

The young calf section in the 2001 Dairy NRC is an excellent addition and reference. Energy and protein requirements appear to be in line with the needs of young calves. Compositional data of ingredients and some milk replacers, starters and growers are provided. There also is a young calf model in which bodyweight and ambient temperature can be varied and different feedstuffs used to evaluate potential calf performance.

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