

# Importance of Milk Feeding Pre-weaning to Dairy Calves<sup>1</sup>

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Similar to any mammal, newborn dairy calves must consume milk in the first weeks of life because of their inability to properly digest dry feeds. On most dairy farms, milk harvested from cows or reconstituted milk replacer powder provides the primary source of nutrients for calves in the first 4–6 weeks of life before they are able to adequately digest other feeds. Table 1 depicts the typical composition of cow's milk and milk replacer.

## Milk Feeding Programs

An efficient calf feeding system is critical because it determines the future income and sustainability of dairy farms. Different milk feeding programs have been evaluated and all of them are used by U.S. dairy farms.

1. *Restricted milk feeding* is the conventional system used by most dairy farms; calves are fed a ½ gallon of milk twice daily, or a total of 1 gallon of milk per day. The goal of this program is to limit milk intake to encourage intake of grain mix.
2. In *Step method*, calves are fed different amounts of milk according to age so that milk intake increases up to 20% of the calf's body weight (calves are fed up to 2.5 gallons of milk) in the first 30 days of age (pre-Step). Then, milk intake slowly declines after 30 days of age to basically no milk being fed at 60 days (post-Step), when calves are weaned.
3. *Ad libitum milk feeding* provides an unlimited amount of milk during a specific time. For example, calves have free access to milk for 30 to 40 minutes twice daily.

## Milk Feeding Implications Growth

The primary goal of most liquid feeding programs for dairy calves is to double the birth body weight within 8 weeks of age at the same time that morbidity — primarily diarrhea, but also respiratory diseases — and mortality are minimized. Increased milk feeding in the first 6 weeks of life typically results in improved daily weight gain when compared with calves fed 1 gallon per day. Providing milk *ad libitum* to calves typically results in 50% greater body weight gain (i.e., 20–25 lbs weight advantage) in the first 30 days of life compared with restricted milk feeding, but it also requires more attention at the weaning phase to assure that grain intake is adequate before milk feeding ceases. Feeding larger volumes of milk in the first 4–6 weeks of age results in better growth (body weight, body length, heart girth, hip, and wither heights) when calves are fed using the Step method compared with the restricted milk feeding method.

Holstein calves fed 1 gallon of whole milk (~1 lb of milk solids) usually consume enough calories to gain only 0.2 lbs of body weight per day. If milk replacer containing 20% fat and 20% crude protein is fed at 1 lb of powder/day to

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a 100-lb calf, then the caloric intake is only sufficient for maintenance of body weight (Figure 1). Because grain intake is usually negligible in the first two weeks of life, it is not uncommon for calves to maintain weight when fed only 1 gallon of milk or milk replacer.

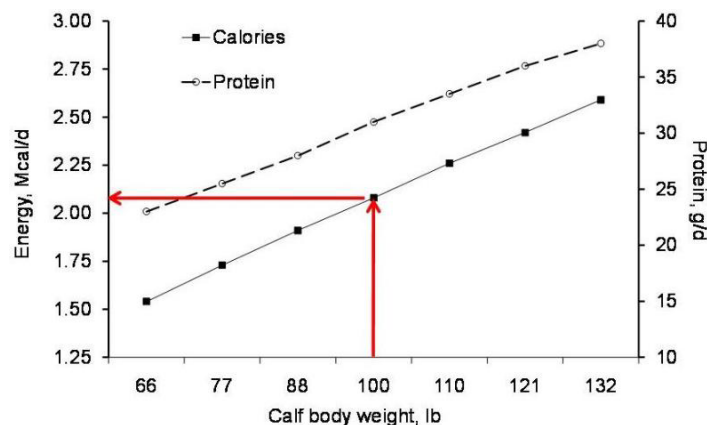


Figure 1. Caloric and protein needs for calves of different body weights to maintain their weight. Calculated based on the metabolizable energy (megacalories per day) and digestible protein (grams per day) using NRC (2001) and Davis and Drackley (1999). Arrows indicate that for a 100-lb calf, the caloric need for maintenance of body weight is 2.1 Mcal/day, which is equivalent to 1 gallon containing 1 pound of reconstituted milk replacer powder.

## Rumen Development

Calves fed restricted amounts of milk are encouraged to increase starter consumption, which typically contributes to the functional and physical development of the rumen. Volatile fatty acids from fermentation of ingested grains stimulate the development of ruminal papillae in the young calf. Therefore, restricting milk feeding after 30 days of age is typically beneficial to grain intake and rumen development. When calves are fed using the Step method or ad libitum method, it is advised to gradually reduce milk consumption after 4 weeks of age so that the transition to the postweaning period results in less nutritional stress.

## Incidence of Disease

Before weaning, calves are highly susceptible to gastrointestinal problems, particularly diarrhea. Diarrhea results in severe dehydration and, in some cases, pathogens that infect the digestive tract invade the bloodstream, causing bacteremia and sepsis. Newborn calves are more susceptible to diseases when colostrum feeding is inadequate and nutrient intake is restricted. Therefore, providing an adequate amount of clean, good quality colostrum in the first hours after birth is critical to the health of the calf. When calves get sick, they need to consume more nutrients in order to maintain the defense mechanisms and mount an

immune response. Therefore, it is critical to assure adequate caloric and protein intake through milk feeding that allows calves to gain weight when risk of diseases is highest, such as in the first 30 days of age.

## Long-Term Effects

In many animal models, it is well documented that the amount of nutrients consumed early in life has long-term effects on future performance. Higher rates of growth observed early in life are associated with reduced breeding age and higher milk yield when the calf matures. In fact, several studies summarized by Van Amburgh et al. (2010) indicate that feeding dairy heifers 2 vs. 1 gallon of whole milk/day increased first lactation milk yield on average 1,610 lbs (Table 2). Similarly, increasing the amount of powder milk from 1.2 to 2.2 lbs/day increased first lactation milk yield by an average of 1,496 lbs.

## Recommendations

Milk provides the primary source of feed for young calves before they are able to digest solid feeds. The standard program of feeding pre-weaning calves 1 gallon of milk replacer reconstituted at 12% dry matter is insufficient for optimum development. In this system, the calf consumes approximately 1 lb of milk solids per day, which is sufficient only to meet the need to maintain body weight of a 100-lb calf. Although this system enhances grain intake, it causes calves to have low weight gains in the first month of age.

Calves should be fed whole milk or a high quality milk replacer containing 28% protein. Start with 1 lb of milk solids (1 gallon) in the first week and gradually increase to 2 lbs/day (2 gallons of milk) in the first 4–5 weeks of age. Gradually decrease the amount offered after the 5<sup>th</sup> week to avoid weaning stress. At 7 weeks of age, calves should be fed only 0.5 lbs of milk solids (½ gallon of milk). Calves should be weaned when grain intake is approximately 3 lbs/day, which typically occurs at 7–8 weeks of age in the Step method. Maintain calves in the same environment for at least 1 week after weaning. When moving them to group pens at 9–10 weeks of age, most calves should be consuming 4–5 lbs of grain per day.

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Table 1. Nutrient content of whole milk and milk replacer.

	Whole milk	Milk replacer
	..... Dry matter basis .....	
Metabolizable energy, Mcal/lb <sup>1</sup>	2.5	2.0 to 2.2
Protein, %	27	20 to 28
Fat, %	31	15 to 20
<sup>1</sup> Mcal/lb = megacalories per pound		

Table 2. Impact of amount of milk or milk replacer fed during the pre-weaning period on first lactation milk production.

Study	Whole milk, gallons/day	Increase in milk production at first lactation, lb
1	1 vs. 2	+ 997
2	1 vs. 2	+ 3,091
3	1 vs. 2	+ 1,144
Milk replacer powder, lb/d		
4	1.2 vs. 2.2	+ 1,100
5	1.2 vs. 2.2	+ 1,542
6	1.2 vs. 2.2	+ 1,841
(Source: Van Amburgh et al. 2010)		