



Early Weaning Strategies

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- Rumen development review
- Effects on growth and health
- Impact on feed and labor costs
- Recommendations for weaning criteria
- Strategies for successful weaning
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Introduction

Latest estimates of average weaning age in the United States indicate that 70% of calves are weaned at 7 weeks of age or later. In addition, 25% of farms surveyed said they weaned calves at 9 weeks or later. Considering that calves with adequate rumen development can be physiologically ready for weaning as early as 3 weeks of age, many farms have a significant opportunity to reduce age at weaning and save money and time spent on calves. Early weaning is not a new concept, but in times of ever-tightening margins, you may benefit from reconsidering your current practice. This factsheet will present some data from recent research into early weaning strategies and offer suggestions to make it work for your farm.

Rumen development: the key to success

First a quick review of rumen development, which is essential for a successful early weaning program. When the calf begins to eat dry feed, especially starter, the rumen begins to supply nutrients produced by fermentation and the population of rumen bacteria begins to grow. Fermentation of the starch component of grain produces volatile fatty acids (VFA), particularly butyrate, which stimulate growth of rumen papillae and metabolic activity in the rumen. After about 3 weeks of eating grain, the calf's rumen will have enough bacteria fermenting enough feed to supply a substantial amount of energy. The rumen bacteria themselves also provide an important source of nutrition—microbial protein—as they are washed out of the rumen, digested, and absorbed in the small intestine. Microbial protein is very digestible and contains a very favorable profile of amino acids relative to the needs of the growing calf.

From a management standpoint, we can assist rumen development by providing free-choice water and a quality grain in the first few days after birth. With this feeding strategy, by 3 to 4 weeks of age the calf's rumen can be well-developed and ready for the change to a diet of solid feeds. The sooner starch is digested by the calf, the sooner rumen development occurs. It takes about 21 days to develop the rumen papillae from the initial time that grain is fed. This development time is from when grain is first fed, be it 2 days of age or 20 days of age. That is where management plays a big role in determining rumen development and weaning age. Assisting the calf in eating those first few bites of grain can have dramatic, positive effects on starting the process of rumen development.

Will calves still grow and be healthy?

Over the years, many research studies have shown no differences between calves weaned at 6 or 8 weeks of age. In addition, many producers regularly and successfully wean calves at 4 to 6 weeks of age. Weaning at this age is cost effective because it gets calves started on dry feeds sooner, saving money on labor and feed costs. Recent research at Penn State has investigated the impact of weaning age on calf performance and first lactation milk production. In two experiments, 124 male and female calves were weaned at 3, 4, 5, or 6 weeks of age and studied through 8 weeks of age. Milk replacer for this study contained 22 percent protein and 15 percent fat and was fed at 10 percent of birth weight. This amounted to about 1.2 pounds per day or 10 ounces of powder per feeding. Milk replacer was reduced by half in the week before weaning. Calves received milk in two feedings per day for the first trial. In the second trial, milk was fed twice per day until 2 weeks of age; then calves received all milk in one feeding per day until weaning. Calves weaned at 3 weeks were fed exactly the same in these two trials. In addition, calves were fed a high quality, free-choice calf starter (22% protein on a dry matter basis) with

special attention to assisting calves to eat if they had not begun consuming starter by 5 days of age.

The table below presents the results of this research. Body weight at 8 weeks of age was the same for all calves and averaged 164 pounds. This meant that calves nearly doubled their birth weight by 8 weeks of age, a good parameter in any calf feeding system. Average daily gains also were similar. Height at the hips and withers was similar too, regardless of weaning age. Calves stood 35 inches at the hips and 33 inches at the withers by 8 weeks of age.

Effect of weaning age on calf growth and starter intake in two experiments.

	Trial 1				Trial 2				SEM ¹
	Weaning Age (weeks)				Weaning Age (weeks)				
	3	4	5	6	3	4	5	6	
Body weight 8 wk, lb	161.2	164.2	157.9	163.4	160.5	163.6	170.2	174.6	3.7
ADG, wk 1 to 8, lb/d	1.10	1.17	1.21	1.23	1.19	1.28	1.52	1.43	0.15
Hip height, 8 wk, in	34.7	34.6	35.1	35.3	35.0	35.1	35.9	36.1	0.6
Withers height, 8 wk, in	32.5	32.7	33.3	33.5	33.5	33.5	33.9	33.9	0.4
Starter intake, lb/d ²									
Pre-weaning	0.60	0.70	0.90	1.08	0.60	1.17	1.61	2.16	0.15
Post-weaning	2.34	2.51	3.02	3.79	2.62	3.31	4.28	5.36	0.18
Feed efficiency, pre-weaning, lb intake/lb gain	4.80	2.52	2.29	2.11	5.67	3.09	3.39	2.62	1.50

¹Standard error of the mean

²Starter intake was greater during trial 2 than trial 1 for calves weaned at 4, 5, or 6 weeks.

An important note in this study was that calves weaned at 3 weeks did not voluntarily eat enough starter in the week before weaning, so starter was hand fed to aid rumen development. For this reason and the fact that 21 days is minimal for adequate rumen development, weaning at 3 weeks is not recommended. However, weaning at 4 weeks is very acceptable under good to excellent management situations.

No differences were seen in calf health throughout these experiments. In addition, rumen development observed at 8 weeks of age was similar for all calves, and no differences in body composition were detected at 8 weeks. Later, DHIA records were collected for calves from these studies and analyzed to see if weaning age affected age at calving or first lactation milk production. Forty heifers were included in this part of the experiment, and PTA (predicted transmitting abilities) for sire and for dam's fat production were included in the statistical analysis. Regardless of age at weaning, all heifers calved at approximately the same age, 23.4 months. First lactation 305-mature equivalent (ME) milk production was projected at 30,090 pounds, with no difference between treatments. Milk composition was not affected either; fat was 3.83% with an ME of 1153 pounds. Protein was 3.0% and the predicted ME was 900 pounds.

Weaning calves earlier cuts feed costs

A 1994 Penn State study that compared the cost of raising calves to 112 days of age estimated that weaning at 30 days instead of 60 days saved \$32 per calf. Weaning at 45 days instead of 60 days saved \$19. Weaning at 30 days saved \$13 compared to weaning at 45 days. If we use 2007 milk replacer costs in this analysis, we see that weaning at 4 weeks may save as much as \$55 per calf over 8-week weaning. Weaning at 45 days will save up to \$30 per calf over 60 days. One interesting point demonstrated by this study (and others in the past), was that grain intake will increase dramatically right after weaning, and in this study intake leveled off at the limit of 6 pounds per head per day as determined by the farm manager. This dramatic increase in intake will occur right after weaning, whether weaning is at 4, 6, or 8 weeks of age. Figure 1 shows the increase in starter intake after weaning in a 1994 study conducted at Penn State.

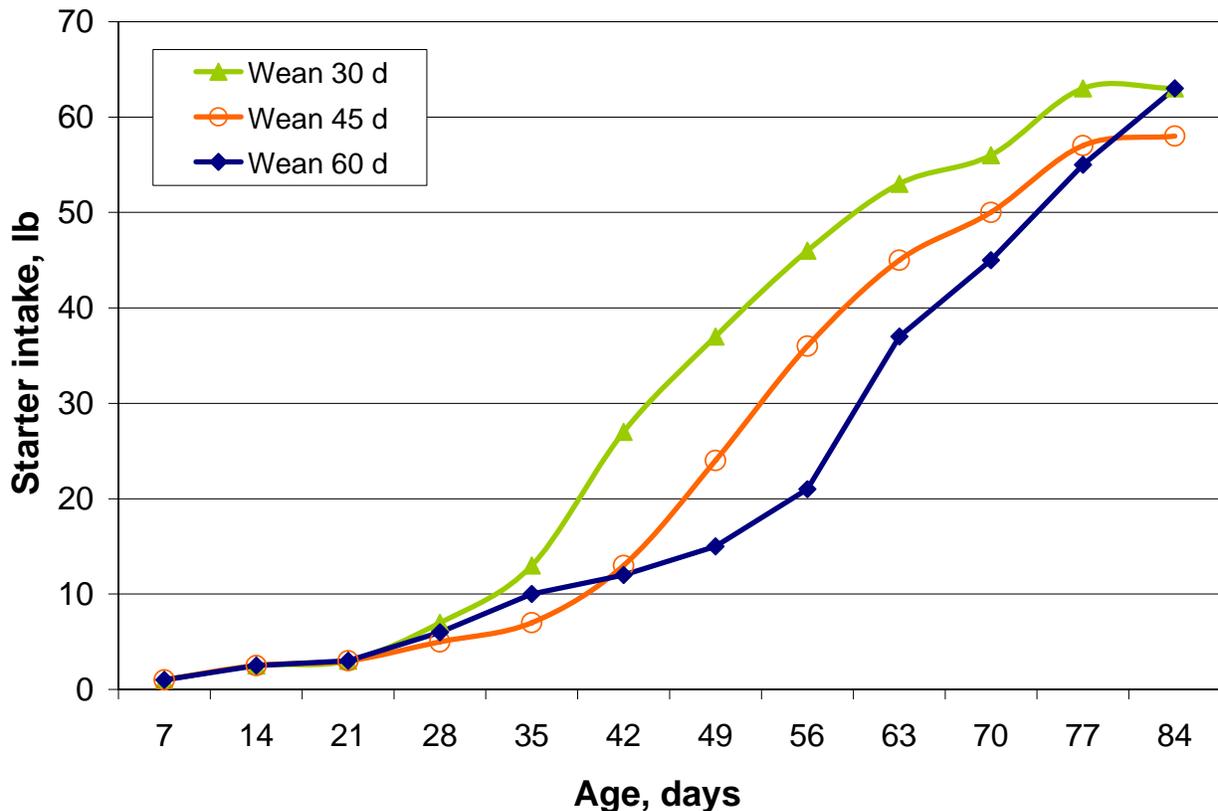


Figure 1. Generally, daily starter intake nearly doubles at weaning and continues to increase rapidly for 2 to 3 weeks until reaching an upper limit (determined by the farm’s feeding program). Data shown here are from a 1994 Penn State study where calves were weaned at 30, 45, or 60 days of age.

Studies done in Wisconsin and Pennsylvania have repeatedly shown that pre-weaned calves are the most expensive dairy replacement animals to feed and care for on a cost per day basis. In addition, these studies show that the first group after weaning is the cheapest group on a per calf per day basis. The age at which you decide to wean calves will have a definite impact on the cost of raising those calves, because *you decide when calves move from the most expensive to the*

least expensive group. Remember ‘tradition’ is not a good basis for determining appropriate weaning age. Just because you’ve always weaned calves at 8 weeks doesn’t mean it is the best time to do so. Grain intake and an adequately developed rumen are far better methods to determine age at weaning.

Milk replacer ingredients have been steadily increasing in price since June 2006 due to direct competition for ingredients that are used in both calf milk replacer and in the human food industry. Many convenience foods use whey proteins to improve food quality and flavor. This competition is real and is likely to remain an issue for the long term. This means that feeding whey-based milk replacer to calves may not be as economical as it used to be. It also means that if we can wean calves earlier, we can reduce the amount of milk replacer fed and be able to control the costs of raising calves, even if the milk replacer price remains high.

How early can calves be weaned?

Calves can be ready for weaning by 3 to 4 weeks of age; however, in Penn State studies calves weaned at 3 weeks required extra attention. The increased time and labor required to get these calves eating starter suggest that waiting until 4 weeks of age would be prudent.

It is essential to remember that early weaning cannot succeed without early rumen development. If the rumen is not prepared to handle dry feeds, the calf will suffer a growth slump for up to 3 weeks after weaning. Incidentally, this post-weaning slump can occur at any age or weaned calf weight if the rumen is not adequately developed. Consumption of calf starter and water lead to the production of volatile fatty acids in the rumen, which in turn stimulates rumen development. This takes about 3 weeks to occur, so successful early weaning requires that grain and water be consumed within the first week of life.

Strategies for easing the transition at weaning

With proper care and management, the vast majority of calves can be weaned by 4 to 5 weeks of age. But avoid making weaning decisions by age alone. Instead, use the amount of starter eaten by calves as the primary indicator of weaning time. Calves that eat 1.5 to 2 pounds of grain per day for 3 consecutive days are ready to be weaned. This method allows individual adjustments to weaning that keep unhealthy calves on milk and allow healthy calves to switch to dry feed. To get calves eating enough starter to allow early weaning, offer free-choice, high quality calf starter at 1 or 2 days of age, and be sure calves are eating some by 5 to 7 days of age. If they aren’t, show them what calf grain is—either by hand feeding some or by putting a small amount in the bottom of the milk bucket after milk feeding. As always, careful attention to calf health is critical and will have a great impact of the success of your calf system.

To use this system, you must know how much starter is fed each day. Weigh 2 pounds of grain and mark the amount on the container used to feed calves to ensure accuracy. Measuring starter intake allows you to adjust weaning dates for calves that fall behind due to an illness, and wean only those that are healthy and eating well. If 5-week weaning just doesn’t seem to work in your situation, there’s a good chance that other factors are involved. Some possibilities include not feeding adequate colostrum, poor ventilation, not feeding high quality calf starter, wet, damp housing, or other sources of stress. At weaning, calves face significant stress due to changes in

their diets, housing, and environments. As a result, calves may lose weight, eat less, and become more susceptible to infection. The key to limiting this post-weaning slump is to minimize stress.

At weaning time milk may be removed abruptly or gradually, but make changes in dry feed gradually. Feed the same starter for a week after weaning and then mix starter with the weaned-calf grain to allow calves to adjust to their grower diet. High quality hay can be introduced to weaned calves once daily grain intake reaches about 5 to 6 pounds, probably around 1 to 2 weeks after weaning, or 6 to 7 weeks of age.

Give calves time to adjust to weaning before adding the stress of moving and adapting to group housing. Wait at least a week after weaning before you move calves to new housing, and limit groups of newly weaned calves to 4 to 6 animals to ease the transition. This allows calves to adapt to the social aspects of group housing. Small groups ease the stress of competition for shared feeding and resting areas. The first group post-weaning clearly appears to be the most important for social adaptation. Beyond this first small group, subsequent groups can be much larger and quite different in terms of feeding systems and management with little, if any, detrimental effects on the growth and development of the heifer.

Since calves commonly encounter a wider variety of pathogens when moved to group housing, only healthy calves should be weaned. Not only will weaned calves be exposed to more pathogens; their immune systems also might be suppressed by the stress of changing diets. Housing areas must have adequate ventilation to reduce the risk of respiratory infections. In addition, the area should be clean and well bedded to limit exposure to fecal pathogens. Continue to feed a coccidiostat in the ration to reduce the risk of coccidiosis; weaned calves are especially susceptible to this disease because the stress of weaning can depress the immune system.

Avoid dehorning or vaccinating calves around the time of weaning as well. These are additional stresses to the calves' systems, and they are relatively easy to plan around. Finally, weaning during weather extremes might worsen stress. Weather can stress calves by changing energy requirements and suppressing the immune system.

Keep them growing after weaning

The objectives of feeding the young calf from weaning to 6 months need to be focused on maintaining her health and growth while developing the rumen as rapidly as possible. Because of the amount and quality of microbial protein produced in the rumen, along with the VFA produced by rumen bacteria; rumen development cannot be overlooked. These VFA are efficient forms of energy for the young heifer. It usually takes 4 to 6 months before complete rumen development takes place. High starch (grain) diets provide the nutrients needed for a rapid rate of rumen growth and development. Weaned calves fed high grain diets will have more rapid rumen development than those fed high forage diets.

For heifers up to 6-months-old, grain is recommended to a maximum rate of 5 to 6 pounds per head per day. This grain should initially contain 18% crude protein on a dry matter basis (calf starter). After the calf has transitioned to new housing, the grain may be reduced to 16% protein on a dry matter basis (these feeds are often called 'grower'). Research shows that the calf and weaned heifer do not need higher levels of protein in their grain,

unless forage quality is extremely poor. Be sure to keep track of grain intakes when calves are offered forage in addition to their grain; the grain is required and the forage is optional. As the animals mature and grow, forage can make up a greater part of their diet while they still get their 5 to 6 pounds of grain per day. This amount of grain should likely be maintained at least until 6 months of age.

Forage quality should be carefully monitored for calves aged 2 to 6 months. Fine-stemmed, mold-free hay is preferred. Fermented feeds such as haylage and corn silage can be fed to calves after weaning, provided that they are high quality. Fermented forages are only palatable as long as they are fresh.

Weaned calves should be fed to grow around 1.75 pounds per day. Research tells us that both faster and slower growth rates result in lower milk production during first lactation. The critical age range for this growth rate is from 2 months until about 10 months of age, before the heifer reaches puberty.

Reference

Kehoe, S. I., C. D. Dechow, and A. J. Heinrichs. Effects of weaning age and milk feeding frequency on dairy calf growth, health and rumen parameters. *Livestock Sci.* In Press, Corrected Proof Available Online 1/22/07. [doi:10.1016/j.livsci.2006.11.007](https://doi.org/10.1016/j.livsci.2006.11.007).

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Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

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