

Feeding and Managing Baby Calves from Birth to 3 Months of Age

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As the future productive units of a dairy herd, heifers represent a substantial financial investment in feed and labor. This investment needs to be protected by managing and feeding these heifers so that they grow economically and at an optimal rate in order to calve at 24 months of age. The first two to three months of life is a critical period to achieving these objectives. This factsheet explains the critical steps in raising calves during this time period. These steps are important for raising not only dairy heifers but also orphan beef calves.

Dry Cow Nutrition Program

Sound feeding and management programs for young calves start with the dam or mother two months prior to calving. The majority of the growth of the calf within the dam occurs within the last two months of gestation, and the dam provides the nutrients needed for this growth. Also, the management program of the dam affects the quality and amount of antibodies found in her colostrum, or first milk, which directly impacts the health of the calf after birth.

Dry cows should be fed a diet that is balanced to meet their nutrient needs and support the growth of the fetus. If a heifer or cow is slightly underfed energy and/or protein, the fetus will still grow to the same size as if she was fed properly, but she will sacrifice her own body reserves or growth to support the growth of the fetus inside her. Basically, the growth of the fetus has a higher nutrient priority than the growth of the bred heifer or the ability of a mature cow to maintain her body fat stores. Underfed heifers will have more trouble calving. Older cows will use their body stores of fat and protein, and these stores will not be available to support milk production after calving. The important message is that underfeeding dry cows and springing heifers does not result in a smaller calf but instead results in lower performance of the cow or heifer after calving.

Adequate minerals and vitamins are important to the dry cow and the calf developing inside her. They are also necessary for the dam to minimize health problems around freshening time, such as preventing retained placentas, and to improve the immune system so that the cow can fight off a disease challenge, such as mastitis infection, just before or after calving. The recommended concentration of selected minerals and vitamins in the total diet is shown in Table 1. In addition, deficiencies of minerals, such as phosphorus, manganese, cobalt, copper, zinc, and selenium, can result in deficiencies in the fetus as well as the newborn calf. Thus, adequate (not excessive) amounts of each mineral and vitamin need to be consumed for the health and well-being of both the dam and the unborn calf.

<p>Table 1. Concentration of selected minerals and vitamins in the total diet recommended for a 1500-lb Holstein dry cow from 240 to 280 days pregnant.</p>
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Mineral/Vitamin*	Dry matter basis
Calcium	0.44 - 0.48%
Phosphorus	0.22 - 0.26%
Magnesium	0.11 - 0.16%
Potassium	0.51 - 0.62%
Copper	12 -18 ppm
Zinc	21 - 30 ppm
Selenium	0.3 ppm
Vitamin E	1168 - 1211 ppm
<p>* Assumes anionic salts are not being fed the last three weeks of gestation.</p> <p>Source: <i>Nutrient Requirements of Dairy Cattle-2001</i> (7th revised edition).</p>	

A very effective way to prevent scours in calves is to vaccinate the dry cow with a scour vaccine before calving. Mature cows should be vaccinated four to six weeks before freshening. Heifers should be vaccinated two months before calving and boosted again one month before freshening. Scour vaccines can include the rota and corona virus, *E. coli*, and/or *Clostridium perfringens*. Individual farms should consult with their local veterinarian to determine the primary cause(s) of calf scours on their farm and for help in selecting the most effective vaccine for their situation.

Care of the Calf at Birth

As calving time approaches, the cow due to calve needs to be watched closely for any complications. Cows and heifers should calve in a clean, dry, grassy lot or a clean, well-bedded pen. Pens should be square and should provide 150 to 200 square feet of space; they should have good lighting and ventilation but be free from drafts. Beef cows can calve outside if a windbreak is available.

The newborn calf should begin to breathe shortly after the umbilical cord breaks. Mucus around the nostrils should be removed. Do not pound on the calf's chest or lift it by the rear legs since this can do more harm than good. Shortly after birth, the navel cord should be dipped (not sprayed) with a 7% tincture of iodine solution. (Do not use teat dip or weaker iodine solutions.)

The cow should be allowed to lick the calf after delivery. In cold weather or if the cow does not lick the calf, the calf should be dried with clean cloths. This practice not only dries the calf but stimulates the calf's blood circulation. Generally, dairy calves are removed from their dam shortly after the dam has licked the calf clean (within one hour).

Early Colostrum Intake = Survival

Colostrum is secreted by the mammary gland shortly before and after calving. True colostrum is obtained only from the first milking. After the first milking and for the next two and a half days, the cow's milk is called transition milk.

Colostrum provides a calf with its primary source of nutrients. As shown in Table 2, true colostrum contains twice as much dry matter and total solids, two to three times as many minerals, and five times as much protein as whole milk. Colostrum also contains various hormones and growth factors that are necessary for growth and development of the digestive tract. Colostrum is lower in lactose, thus decreasing the incidence of diarrhea. Milk obtained after the first milking is inferior in quality to the first milking and should not be fed to the newborn calf as colostrum milk.

Table 2. Typical composition of colostrum (first milking after calving), transition milk (second and third milkings after calving), and whole milk.

Component	Milking after calving			Whole milk
	Colostrum	Transition Milk		
		1st	2nd	
Total solids (%)	23.9	14.1	13.6	12.9
Fat (%)	6.7	3.9	4.4	4.0
Protein (%)	14.0	5.1	4.1	3.1
Lactose (%)	2.7	4.4	4.7	5.0
Calcium (%)	0.26	0.15	0.15	0.13
Immunoglobulins (%)	6.0	2.4	1.0	0.1

Taken from: *Feeding the Newborn Dairy Calf*. Special Circular 311. Pennsylvania State University.

Calves are born with little defense or immunity against disease. They acquire resistance to disease from their dam through *timely* and *adequate* intakes of *high-quality* colostrum, their mother's first milk. Calves that do not receive adequate amounts of quality colostrum early in life are more susceptible to diseases. Holstein calves should be hand-fed 5 to 6 pints or 3 quarts of good quality colostrum within an hour of birth and again within 12 hours or the next regular feeding. (Feeding 6 pints of colostrum will not cause a Holstein calf to get scours.) The amount of antibodies absorbed is related to the timing of colostrum feeding after birth. Within six hours after birth, the ability of the gut to absorb antibodies decreases by one-third. By 24 hours, the gut can absorb only 11% of what it originally could have absorbed at birth. Also, at 24 hours of age, digestive enzymes break down and digest all of the antibodies.

Oftentimes, farmers let the calf nurse its dam. Research has shown that many of these calves do not nurse adequate amounts of colostrum from their dams within the first few hours of life, and thus they may not receive adequate immunity to fight off disease. Hand-feeding newborn calves is recommended so that a dairy farmer knows how much colostrum an individual calf receives.

Colostrum should be very thick and creamy. The quality of colostrum can be determined using a colostrometer (available through Nasco catalog). Superior quality colostrum contains greater than 50 mg/ml of immunoglobulins. Before milking the cow, its teats should be cleaned. Newborn calves should not be fed colostrum that is thin, bloody, mastitic, or obtained from cows testing

positive for Johne's disease. Calves that do not readily consume their colostrum can be fed using an esophageal feeder. Three to 5 half-gallon containers of quality colostrum should be stored in a non-frost-free freezer for up to one year for feeding to calves born to dams with mastitis or no milk. Colostrum from dairy cows can be fed to beef calves. Colostrum should be thawed in warm water (not hot water) or in a microwave on low power for short periods where the thawed liquid is poured off periodically into the container used to feed the calf and the unthawed liquid returned to the microwave.

After the initial feeding of colostrum, for the next three days calves should receive transition milk from their dam or other cows in the herd all of which test negative for Johne's disease.

Calf Housing

Calves should be housed individually in facilities which are draft-free but provide good ventilation. One way to house calves to prevent the spread of disease from one calf to another is to use calf hutches. These can be purchased commercially or built on the farm. They should be located on a surface with adequate drainage and bedded with straw especially in the cooler times of the year. During the winter, the hutch opening should be placed facing the south to allow the winter sun inside. In the summer, calf hutches should be shaded to decrease heat stress and to help improve the immune system of calves. After each calf is removed, calf hutches should be cleaned and moved to a new location to control the spread of potential diseases.

Milk Feeding Options

For the first two weeks of life, calves receive most of their nutrition from milk. From four days of age, calves can be fed either whole milk, waste milk, reconstituted milk replacer, or fermented or fresh colostrum (Table 3). The type of milk fed is determined by price, availability, and convenience. Calves are generally fed milk twice daily from a nipple bottle or bucket, or they can drink from an open bucket. When milk or reconstituted milk replacer is fed to calves from either a nipple or open bucket, the esophageal groove closes and milk bypasses the rumen and is shunted from the esophagus into the abomasum or true stomach. The groove closes in response to nervous stimulation and is active in calves until about 12 weeks of age.

Table 3. Amount of whole or waste milk or diluted fermented colostrum to feed young calves. Calves are weaned after they are older than 30 days of age *and* are eating 1.5 to 2 lbs of calf starter daily for three days in a row.

Age in days	Milk source	Daily amount (quarts)	
		Holstein/ Brown Swiss	Smaller breeds
4 days until weaning from milk	Whole or waste milk or diluted fermented colostrum	4-5 quarts daily <i>or</i> 2-2.5 quarts/twice daily feeding	3-4 quarts daily <i>or</i> 1.5-2 quarts/twice daily feeding
Milk replacer powders should be reconstituted with warm water and fed according to directions on the bag.			

To prevent the spread of Johne's disease to young calves, colostrum, fermented colostrum, whole milk, or waste milk should be obtained from cows testing negative for Johne's disease, or it should be properly pasteurized using a batch pasteurizer. These pasteurizers require that the milk be held at 65.5°C or 150°F for 30 minutes. Proper use of this equipment has been shown to kill the bacteria associated with this disease.

Whole Milk

Whole milk can be used to feed baby calves. Calves should be fed daily approximately 10% of their birth body weight (1 quart of milk weighs 2 pounds). For example, a Holstein calf weighing 90 pounds at birth would be fed 4.5 quarts (9 pints) of milk daily or 2.25 quarts per feeding when fed twice daily. Feeding less milk than this amount results in poor growth due to lack of needed nutrients. Overfeeding and sudden changes in the amount of milk can cause digestive upsets and scouring. Overfeeding milk to calves decreases consumption of dry feed or grain, thus prolonging weaning time.

Waste Milk

Waste or mastitic milk can be used to feed calves. Calves should be fed approximately 10% of their birth body weight (1 quart of milk weighs 2 pounds). Milk from treated cows should only be used to feed calves raised for herd replacements or those kept for eight to 12 weeks after the last feeding of such milk. *Do not feed waste milk containing antibiotics to calves intended for slaughter.* Calves should be individually housed so that they cannot suck one another. Do not feed calves waste milk that is watery or that comes from quarters showing signs of severe mastitis, from cows with an elevated temperature, from cows that are off-feed, or from cows shortly after they have been treated with antibiotics.

Milk Replacers

Milk replacer powders are reconstituted with warm water and make an excellent and oftentimes economical liquid feed for baby calves. Especially during the first three weeks of life, calves should be fed a milk replacer that contains all milk proteins made from dried skim milk or whey products. Whey products can include whey protein concentrates, dried whey, and delactosed whey. Milk replacers should contain a minimum of 18 to 22% crude protein, 10 to 22% crude fat, and less than 0.5% crude fiber. They should be mixed and fed according to the manufacturer's directions. During cold weather, calves should be fed a milk replacer containing 20% fat, and more milk replacer powder should be fed.

Fermented Colostrum

Fermented or sour colostrum can be used to feed calves. Studies have shown that weight gains in calves are similar to those fed milk or milk replacers when fermented colostrum has been properly fermented and diluted when fed. Fermented colostrum represents all of the surplus milk and colostrum collected from cows for the first three days after calving. This milk can be stored in a plastic garbage can lined with a disposable plastic liner (for ease of cleaning). Milk from cows treated with antibiotics should not be added to fermenting colostrum since the antibiotics will kill the fermenting organisms. Colostrum ferments best when the temperature is between 60° and 80°F and should not be stored in direct sunlight. Under 60°F, fermentation is slow; when the temperature exceeds 80°F, fermentation is rapid and may result in undesirable organisms being involved in the fermentation process. The addition of small amounts of acid preservatives can extend the life of the fermented colostrum and decrease undesirable fermentation. Fermented

colostrum takes approximately 10 to 14 days to ferment and can be stored an additional 14 to 30 days.

Calves can be fed fermented colostrum at four days of age. Fermented colostrum should be diluted with warm water (not hot water) at the rate of 1 part warm water to 2 parts fermented colostrum. Calves should be fed daily approximately 10% of their birth body weight (1 quart of milk weighs 2 pounds) of the reconstituted mixture.

Calf Scours

Calf scours or diarrhea can be caused by overfeeding milk or by bacterial, viral, or protozoal ("crypto" or coccidia) infections. Farmers should work with their local veterinarians to identify the cause and develop a preventative program. Diarrhea in calves results in losses of water and electrolytes, such as sodium, bicarbonate, chlorine, and potassium. Scouring calves can lose 10 to 12% of their body weight in water losses. These imbalances must be corrected quickly or death can result. Depending on the severity of the diarrhea and dehydration, calves may need to receive oral electrolyte solutions once daily or as many as four times a day. Calves that cannot suckle should be fed electrolytes with an esophageal feeder. Calves should be fed their regular allocation of milk when receiving oral electrolytes. The milk supplies the calf with energy and other nutrients needed for survival. Oral electrolyte products are available commercially, or in an emergency, they can be made using common kitchen supplies (Table 4). Electrolytes should be given 30 minutes to 1 hour after feeding milk.

Table 4. Emergency recipe for electrolyte solution for scouring calves.

1 package of fruit pectin
1 teaspoon Lite Salt ®
2 teaspoons baking soda
1 can beef consommé
warm water to make 2 quarts

Calf Starter and Water Important for Rumen Development

For the first part of life, the calf functions as a simple-stomached or monogastric animal. At birth, the first three components of the stomach—the rumen, reticulum, and omasum—are undeveloped and do not aid in digesting feeds for the very young calf. When the calf starts to eat calf starter (mixture of grains, protein source, minerals, and vitamins) and to drink water, the rumen starts to develop.

Calf starter should be fed to calves starting at four days of age. Calf starter should be formulated to include very palatable ingredients and to contain adequate protein, minerals, and vitamins. Table 5 lists the recommended nutrient content of a calf starter, and Table 6 shows a sample recipe for a home-mixed calf starter. A coccidiostat or coccidiocide, such as Deccox®, Bovatec®, or Rumensin®, should be included in the calf starter.

Table 5. Nutrient composition for calf starters.*

16-20% crude protein
0.70% calcium
0.45 % phosphorus
0.65 % potassium
10 ppm copper
40 ppm zinc
40 ppm manganese
0.10 ppm cobalt
0.30 ppm selenium
1818 IU Vitamin A/lb dry matter
270 IU Vitamin D/lb dry matter
12 IU Vitamin E/lb dry matter

* Adapted from *Nutrient Requirements for Dairy Cattle--2001*

Table 6. Sample recipe for a home-mixed calf starter (18% crude protein).

700 lbs rolled or coarse ground oats
600 lbs cracked corn
475 lbs 48% soybean meal
150 lbs molasses
15 lbs white salt
15 lbs dicalcium phosphate
20 lbs limestone

enough trace mineral and vitamin premix to meet needs listed in Table 5

addition of a Deccox®, Rumensin®, or Bovatec®

The calf starter along with water helps the rumen of the calf develop. As shown in Figure 1, for the first two weeks of life, calves will just nibble calf starter. They should be given no more than a 6-ounce coffee cup of starter daily with the refused feed removed daily and fed to older heifers. Intakes of the starter increase the third to fourth weeks of life. **Hay should not be fed until calves are weaned and/or they are eight weeks of age.**

Figure 1. Effects of age on the consumption of a ground calf starter. For the first two weeks of life, calves just nibble calf starter, but this small amount of starter is important in early rumen development. Results are from a trial at the University of Kentucky.

In addition to the calf starter, water should be provided free-choice starting at four days of age. Feeding calves free-choice water increases starter intake and weight gain. In a research study, depriving calves of drinking water decreased starter intake by 31% and decreased weight gain by 38% over those calves provided water free-choice. Free-choice water enters the rumen and along with high-quality calf starter helps convert a calf from a simple-stomached animal to one with a functional rumen that can utilize forages and grains. When calves are fed milk or reconstituted milk replacer, milk is funneled through the esophageal groove to the true stomach and not into the rumen. Thus, milk or water added to milk will not provide water for the bacteria to grow in the calf's rumen. Clean, fresh water must be provided separately, free-choice. Water must be provided free-choice throughout the year, not just in the summertime. During extremely cold weather, warm water should be offered two or three times daily.

Weaning Calves

Calves can be weaned from milk when they are eating daily 1.5 to 2 pounds of starter for three days in a row. Thus, calves should not be weaned based on age but rather on the basis of their intake of starter. Some calves can be weaned at four weeks of age, whereas others may be up to 10 weeks of age. Calves can be weaned from milk either abruptly or gradually over three to seven days.

Feeding Calves Shortly after Weaning

After weaning, changes in the grain mix and group housing should be made one at a time, and changes should be made gradually over a two-week period. Heifers from two to four months of age should be grouped in small groups of four to six heifers. Calves need to stay in small groups for the first two months after weaning so that they can adjust to group feeding and to minimize competition among heifers for feed. Excellent quality hay should be fed to Holstein calves after they are consuming 5 to 6 pounds of grain daily (Jerseys need to consume 4 pounds of grain). Once the heifers are consuming their grain, the best quality hay needs to be allocated to these young heifers. Heifers should not be fed grain mixes containing urea or silages or pasture as the sole forage until after they are four months of age. Grain mixes fed from two to three months of age should contain 18% crude protein assuming early cut alfalfa/grass hay is fed containing 18% crude protein and 35% acid detergent fiber.

Management Practices

At birth, calves should be identified with an ear tag or tattoo and/or a sketch or photograph. Records should be kept to identify the birth date and at least the sire and dam of each heifer. Some farmers, besides recording this information in their record-keeping system, print this information on the ear tag itself.

At birth, calves can be given an oral vaccine to prevent scours. However, preference is to vaccinate the dry cow to provide the calf with the needed protection through consumption of the dam's colostrum. At two to three months of age, calves should be vaccinated for blackleg with a seven-way Clostridial vaccine.

When the horn button is visible, the calf can be dehorned easily with a gouge or electric dehorner. If caustic paste is used, take special caution to avoid getting paste on other parts of the body. Dehorning calves under one month of age is less stressful on the calf and is easier to accomplish than waiting until heifers get older.

Extra teats should be removed with sterile scissors when calves are vaccinated at four to six months. Make sure that the correct teat is removed. Tincture of iodine is swabbed on the area where the teat was removed, and the area needs to be checked daily for infection and to see that it is healing properly.

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