

Early Nutrition and Weaning of the Dairy Calf



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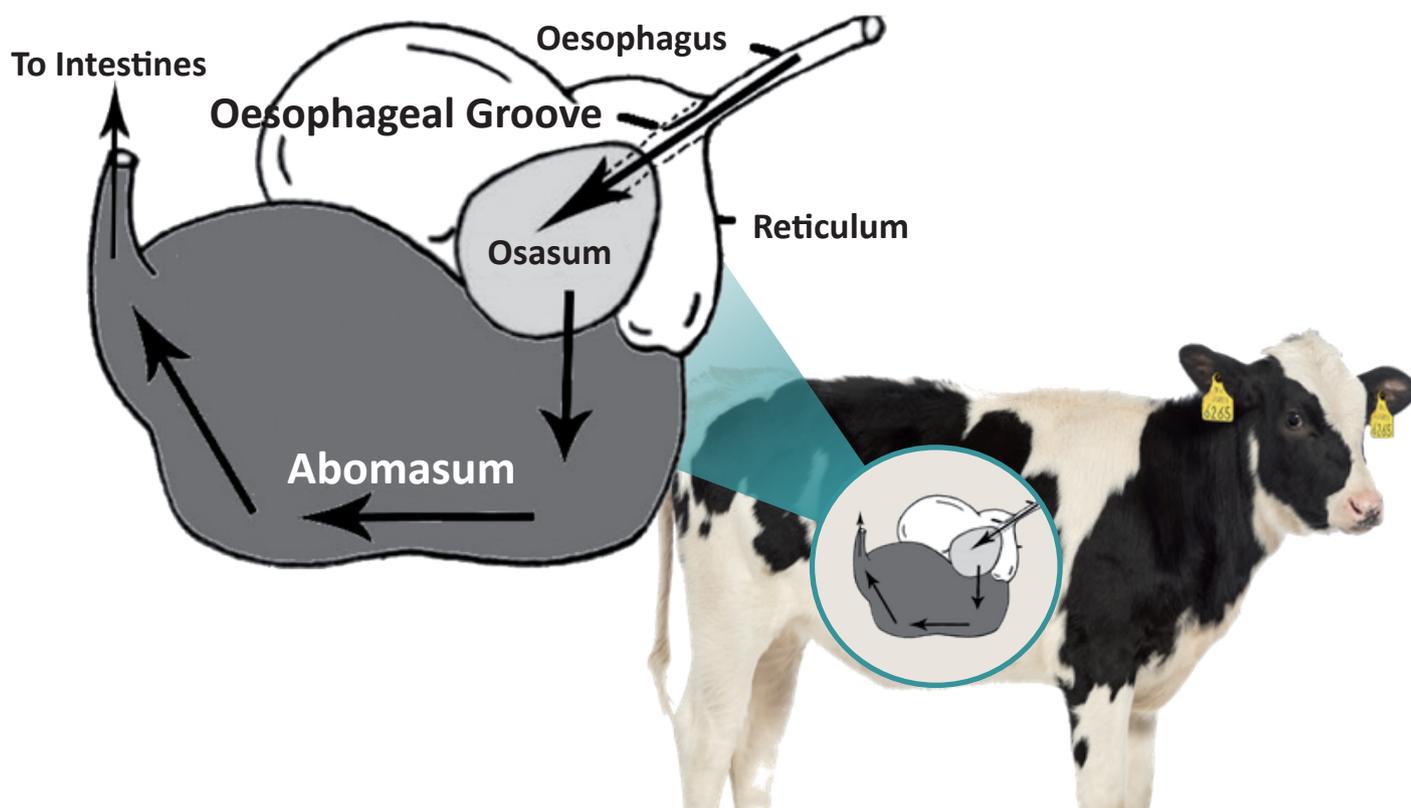
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What is the critical period of nutrition for the milk fed calf?

The importance of colostrum is discussed in the AHI leaflet on Colostrum Management. This is the first step in beginning the process of development of calf digestion. Even after birth, the intestinal tract continues to develop, so to enhance the development of this gut it is important that the calf gets the best nutritional start possible.

During the first weeks of life the calf is entirely dependent on milk as a source of nutrition, with the digestion of milk occurring in the abomasum. Young calves are pseudo-monogastric animals meaning that they have little to no rumen development in early life. It is the transition from wholly relying on milk and adequate rumen development that enables a calf to be successfully transitioned to a non-milk diet at weaning. Pre-weaning nutrition affects calves' growth rate, their health, and their ability to deal with stress and thermal conditions. Calf nutrition in the pre-weaning period needs to be a careful balance of achieving adequate growth rates, while balancing milk intake with rumen development to get the calf weaned successfully.



Newborn calves are totally dependent on milk as a source of nutrition. The abomasum (the fourth stomach) is the only stomach working at this stage. For the milk to enter the abomasum, the oesophageal groove has to close by reflex, so that milk does not spill into the rumen. This works best if calves suckle from a teat or nipple. It does not work as well in calves that drink from a bucket. If the reflex doesn't work, the calves will get sick and will not thrive.

Milk feeding

Whether or not transition milk is fed and for how long is usually specific to the disease control programmes in place and the goals of the farm. The type of liquid feed given to calves following colostrum and transition milk feeding depends on many factors, such as the availability of milk and milk price, the disease status of the farm and labour availability.

The diet will usually consist of either good quality whole milk or milk replacer. Waste milk, (non-saleable milk due to high SCC or antibiotic treatment) should not be fed to calves. If whole milk is fed as the main liquid diet to pre-weaned calves it is important that its consistency is maintained. Hygiene practices related to storage and bacterial loads in whole milk can vary and impact the quality of the diet for calves. If milk replacer is being used it must be mixed correctly as per the manufacturer's instructions using hygienic practices and again consistency (e.g. same powder mixing rate and water temperature used daily) is hugely important for calf nutrition.

Milk feeding systems

There are a number of milk feeding systems. Each has both advantages and disadvantages, and it is important to be aware of these. Consistency of routine is important and monitoring the success of the feeding system by measuring growth rates and health outcomes is key to ensuring good growth rates and good health in calves.

Milk feeding system	Brief description
Ad-lib feeding	Calves fed ad-lib (warm/cold), with access to milk 24 hours a day. Maximises early growth but reduces starter intake.
Twice-a-day feeding	Calves fed twice during a 24 hour period. More labour intensive but allows for good calf supervision.
Computerised/automated feeding	Calves fed little and often over a 24 hour period. Fed according to pre-programmed feeding curve. Good calf housing is essential.
Once-a-day feeding	Calves are fed once daily which reduces labour. Calves must be at least four weeks of age before starting to feed milk once-a-day.

(Source: Teagasc Milk Feeding Manual)

Under EU law, calves must be fed twice-a-day. The abomasum of a newborn calf is not large enough to deal with the recommended volume of milk if it is given in one feed. Therefore, milk should be fed twice-a-day at the start. When a calf is consuming concentrates and its rumen is sufficiently developed, one of these daily feeds can be a dry feed in the form of calf starter. From four weeks of age, studies show that cold whole milk or milk replacer can be fed once-a-day if so desired with no difference in weight gain or scour incidence. However, young calves have a behavioural need to suck, and providing more opportunity for them to do so may be better for their welfare. If once-a-day feeding is practiced, calves must still be checked thoroughly twice daily and fed concentrate at an alternative time to milk feeding, e.g. feed milk in the morning and concentrate in the evening.

How much should I feed?

When feeding whole milk, we consider an average of 12.5% solids content (125g in one litre of whole milk). The concentration of whole milk can range from approximately 12% to 15% solids, depending on many factors. Assuming 12.5% solids, calves should receive 13-15% of their body weight in their liquid feed. This means feeding approximately **six litres of whole milk to an average sized Friesian calf**. See Table 1 for guidelines on feeding volumes (at a rate of 12.5% solids).

Milk replacers (product depending) are usually fed at a rate between 12.5% and 15% solids basis, (that is 125-150g per litre). You should always follow the manufacturer's instructions when feeding milk replacers. (For information on choosing milk replacers please [click here](#).)

Sometimes milk replacer is mixed at a concentration of 20% (200g per litre), this results in a lower volume of liquid but still contains the nutrition and energy the calf requires. However, caution needs to be exercised as this practice can change the osmolality of the milk replacer and cause abomasal bloat. If undertaking this practice, the milk replacer also needs to be of good quality to sufficiently mix to that amount i.e. dissolve completely – the maximum concentration a milk replacer can be mixed to will be specified on the bag.

There are several reasons why feeding 13 to 15% of the calf's body weight is considered optimum:

- Not all breeds of calves have the same average weight. If all calves are fed the same amount of milk, then heavier calves will not get enough to even maintain their weight and lighter calves will be too full and will be slower to consume concentrates.
- There are many situations in which calves need more energy than just for maintenance and growth e.g. temperatures below 15°C, heat stress, disease, or after vaccination. Under these circumstances if calves are fed less, they may be severely underfed and will not have the energy to spare to fight the stresses.
- Heifers that grow faster before weaning calve earlier and have higher milk producing potential.

Table 1. examples of feeding rates for different sized calves.

Breed of calf	Holstein, Friesian, HF X Norwegian Red Cross	HF X Jersey cross	Jersey
Average birth weight (kg)	35-40	32	28
Volume of whole milk or milk replacer fed L/day up to day 5*	Minimum 5L (625g)	Minimum 4.5 L (562.5 g)	Minimum 4 L (500 g)
Volume of whole milk or milk replacer fed L/day after day 5*	Minimum 6L (750g)	Minimum 5L (625 g)	Minimum 4.5L (562.5 g)

*assuming 12.5% concentration

Which is better: nipple or bucket?

Feeding calves from a nipple is more natural. Drinking from the nipple takes longer and helps the calves satisfy their need to suckle. It is preferable from a behavioural point of view. However, most calves can be fed successfully from a bucket, once trained. The feeding method does not have a major impact on weight gain.



Can I feed waste milk to my calves?

Waste milk is milk that is not saleable. It usually refers to milk from cows which have been treated with antibiotics and whose milk is within the recommended withdrawal period. It can also include milk from cows with high somatic cell count. There are a few reasons why you should not feed raw waste milk to your calves.

Antibiotic residues

Milk from cows that have been treated with antibiotics and which is within the withdrawal period will contain residues from those drugs. This can affect the taste of the milk resulting in the calves not drinking as much as they should. Even worse, it can lead to the development of bacteria that are resistant to these antibiotics.

Conclusion: Milk from cows that are undergoing antibiotic treatment should not be fed to calves.

High bacterial contamination

By its nature, waste milk is usually high in bacteria, especially if it contains high cell count milk. It will deteriorate even further if left at room temperature until it is fed. Healthy cows can in fact, transmit disease to their calves. Typical examples are Johne's disease and Mycoplasma, which can be transmitted through the milk from apparently healthy cows to calves at their most vulnerable stage. Other examples include *Salmonella* and *E. coli*.

One strategy to decrease pathogen load and still utilise waste milk is to pasteurise the milk. Pasteurisation is a method of exposing milk to elevated temperatures for a period of time as a means of reducing the bacterial contamination. Temperatures should not go above 60°C. Pasteurisation kills bacteria that can cause diseases in humans and animals. However, the equipment needed to pasteurise milk is a significant farm investment.

If the milk can't be pasteurised within 3 hours of collection, it should be refrigerated until pasteurisation can be done, to prevent fermentation and bacterial growth. This is very important, since a heavy bacterial load in waste milk will not be eliminated completely by pasteurisation.

Conclusion: Milk with a high bacterial contamination should only be fed to calves after pasteurisation.

Transition milk

Milk from approximately the first six to eight milkings, after colostrum, is known as transition milk. Depending on the disease status of your farm, feeding raw transition milk from healthy cows and excess saleable milk should have a lower risk than feeding raw milk contaminated by antibiotics or high in somatic cell count. If milk is not being fed to calves immediately it should always be refrigerated to prevent bacterial growth and should only be kept for a short time. Best practice is however, to pasteurise transition milk.

Conclusion: Transition milk and saleable milk should ideally be pasteurised and chilled to 37°C celsius before feeding to calves.

Why are starter concentrates important for calves?

When a calf is born, the rumen is very small and undeveloped. It does not contribute to digestion at all at this stage. To encourage early development of the rumen, the calf needs to start eating calf starter concentrates and drink water. This development is both physical and microbial, both of which are critical for sufficient rumen function.

The development of the rumen is important to ensure a smooth transition from milk feeding to an adult diet at weaning without setbacks in growth rates or digestive upsets. Calves only begin to eat considerable amounts of starter concentrates from 3 weeks of life onwards. The amount of starter calves will eat depends on the amount of milk fed, therefore, as the calf gets older, a balance is required between feeding enough milk for growth but ensuring enough starter intake to promote rumen development. Thus, the time of weaning is somewhat dependent on the feeding regime.

For a calf the intake of calf starter concentrates is the single most important factor for the development of the rumen. For this reason, it is important that calves have access to clean and palatable starter concentrates as soon as possible, even though they will only eat small amounts in the first 3 weeks. If you provide only small amounts fresh every day, it is more hygienic with less wastage, it increases the calf's desire to eat them and you will see when the calves need more. When feeding fresh concentrates, it is best to clean out unfinished concentrates and feed to older animals.

Calves fed coarse starter mix initially eat more and have higher weight gains than calves fed pelleted starters.

Why is water important for calves?

The development of the rumen depends on the chemical end-products of bacterial fermentation from the starter concentrates. For the fermentation to take place, the bacteria need water. Regardless of what milk feeding system is used, calves need free access to clean, fresh drinking water at all times from the first week of life.



Do young calves need a forage in their diet?

Inclusion of forage to supplement the calf's diet is beneficial to the development of the rumen but is not as fundamental as concentrates. The requirement for roughage depends somewhat on the type of starter concentrates that are fed. Calves need small amounts of roughage, but if fine ground pelleted rations are fed, additional roughage will be necessary for the development of the rumen.

Straw is an easier roughage feed for calves to digest. It also results in greater production of saliva, thus providing additional enzymes for digestion and encouraging the consumption of concentrates.

It is more difficult for hay to pass through the calf's system and it encourages less saliva production (saliva helps with concentrate digestion). A high intake of hay in young calves will decrease the intake of the all-important starter concentrates, and the calves will often develop 'hay bellies'. In this situation, the rumen is stuffed with hay which cannot be properly digested and ruminal development is delayed.

When can I wean calves?

This depends on which system of milk feeding is used and when concentrates are introduced. Weaning should begin only in a healthy calf that is consuming sufficient amounts of concentrates.

The driving force of weaning should be a healthy calf with a sufficiently developed rumen. An indicator of a sufficiently developed rumen is when calves are eating 1 kg of concentrates per day for 3 or more consecutive days. This usually happens from about 8 weeks of age when calves had access to clean and palatable starter concentrates from the first week of life and are fed 13-15% of their birth bodyweight as milk. If starter concentrates are limited or larger volumes of liquid feed are given, weaning may need to be delayed or an alternative weaning program developed.

When calves suckle cows, they are not weaned for up to 10 months of age. In this scenario rumen development is far slower and so weaning is later.



How should I wean them?

Regardless of what system is used, calves must be weaned gradually. When we fail to wean gradually, we stress the calf's digestive system and predispose them to illness such as pneumonia and subsequent growth checks.

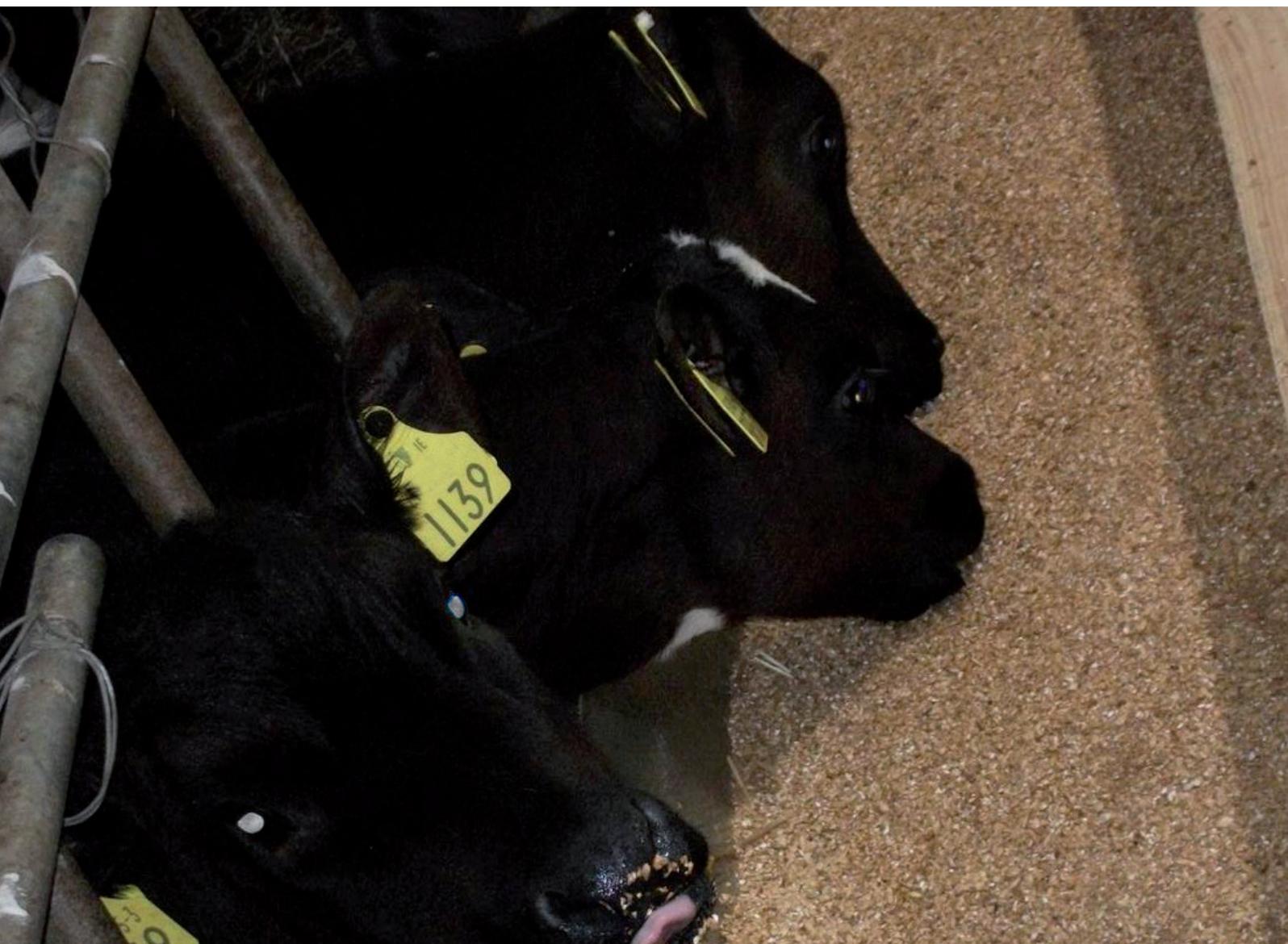
Manual feeding systems

If calves are being fed manually more than once a day, the first move is to change to once a day feeding. This is best done approximately 1 month prior to weaning allowing calves time to adjust to the new regime and further develop their rumen prior to reducing total liquid feed amount. Once they are accustomed to one feed daily and consuming concentrates, reduction in liquid feed can begin.

If feeding milk replacer instead of whole milk, it is important that both the solids content and water content of milk replacer are reduced together. Reduction of milk or milk replacer feeding should ideally be carried out over the course of two weeks, reducing the amount of liquid feed every other day.

Automatic feeding systems

In automatic feeding systems calves can be fed 3-5 times per day and often larger amounts total daily liquid feeds are also offered. In these systems it is far more difficult to ascertain the level of concentrate feed that any individual calf is consuming, therefore weaning should be as gradual as possible. This involves a weaning protocol of approximately four weeks, reducing the amount very gradually so that calves are weaned gradually.



For more information consult the Animal Welfare Guidelines issued by the Farm Animal Welfare Advisory Council
<http://www.fawac.ie/media/fawac/content/publications/animalwelfare/Calf%20Welfare%20Guidelines%20%20FAWAC.pdf>

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