Factsheet

Dry Cow Nutrition for a Successful Transition into the Milking Herd

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Introduction

The purpose of this factsheet is to review the nutritional requirements of dry dairy cows to minimise the risk of transition diseases and ensure a successful transition into the milking herd. The importance of energy supply and the correct body condition score for calving are discussed, along with protein, trace element and vitamin requirements. The various nutritional strategies for milk fever control are also covered, including the low calcium approach, DCAB (dietary cation-anion balance) rations with anionic salts and the use of calcium binders.

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The Importance of Body Condition Score

Cows should be dried off at a body condition score of 3-3.25 and calve down at this same score. Therefore, the goal of nutrition during the dry period is to maintain body condition, with no change in score between drying off and calving.

Cows that calve in too high a condition score are four times more likely to develop milk fever. They also have lower dry matter intakes, lose more condition in early lactation, are more susceptible to ketosis, have poorer fertility and produce less milk. On the other hand, cows that calve in too low a condition, will also produce less milk, be more prone to claw horn lesions (sole ulcers, sole haemorrhage and white line disease) and have more difficulty getting back in calf.

Figure 1. Cows in different body condition scores.

Score 2 (too thin)

Score 3 (correct score for drying off and calving)

Score 4 (too fat)

Dry Matter Intake (DMI)

While it is important to avoid overfeeding energy during the dry period, DMI should be maximised to achieve a rumen fill score of 4 or 5. A good appetite pre-calving will aid early lactation DMI and hence milk production. Good intakes post-calving will also help keep the rumen full and reduce the risk of a displaced abomasum.

DMI during the dry period will vary depending on the quality of forage fed and the NDF (neutral detergent fibre) content of the diet but as a rough rule of thumb, intake should be in the region of 1.7 to 2% body weight i.e., a 700kg cow will eat 12-14kg dry matter (DM). Intake is likely to be at the lower end of this scale in the last three weeks before calving as appetite declines. A DMI of around 12kg should be the target for the close-up period (last three weeks before calving).

Energy

Energy requirements for dry cows are significantly lower than that for milking cows. Feeding a two-stage dry cow ration will allow any alteration to condition to be made in the far-off period if necessary. During the early part of the dry period, aim for an energy density of the ration around 9MJ/kg DM by feeding low quality forages. Straw may have to be included in order to restrict energy intake, with a target intake of around 100MJ for a 700kg cow.

During the last three weeks before calving, the energy density of the ration should be increased by including some of the milking cow concentrates (typically 2-4kg), with a target energy intake of 120MJ/day. The inclusion of concentrates will help the rumen bugs better adapt to the higher energy milking ration post-calving. If one dry cow ration is to be fed for the whole of the dry period aim for 110MJ intake/day.

Overfeeding energy during the dry period may not necessarily be visible by cows gaining condition but internal fat deposition can occur. This can have a similar effect to fatty liver syndrome, reducing appetite post-calving and increasing the severity of negative energy balance and risk of ketosis.

Protein

Sufficient dietary protein during the dry period is important to minimise the mobilisation of body protein reserves before calving. It also helps to ensure adequate colostrum as well as milk production in early lactation. Cows can start to mobilise protein reserves in the last two weeks before calving and this continues until six weeks after calving. Therefore, dry cows need an adequate supply of metabolisable protein (MP), without greatly exceeding their energy needs to enable greater nitrogen retention in tissues and reduce protein mobilisation around calving time. This helps improve protein status of the cow at calving when dry matter intake is low. If protein requirements are not met, this can place stress on the cow's immune system, and increase the risk of transition diseases (retained placenta, metritis and mastitis), as well as lower colostrum quality, milk yield and fertility.

The target for MP intake for dry Holstein-Friesian cows is a minimum of 1100g/day and as a guide, aim for a minimum of 1000g/day MP in the far-off period and 1200g/day for close-up cows. It can be difficult to achieve 1200g MP on high straw diets where intakes are around 12kg DM.

While cows do not have a crude protein requirement and the focus should be on g of MP supplied, a general guide is to aim for a crude protein content of 12% in the dry matter for a far-off ration and 14% for a close-up ration. When feeding one dry cow ration then 13% is a suitable target.

An undegradable protein source (e.g., soyabean meal or a protected rapemeal product) is beneficial in the dry cow diet as microbial protein production can be compromised with low energy diets that typically have a low level of fermentable carbohydrates (starch). This will enable MP requirements to be better met, along with an improved amino acid profile.

Amino Acids

Methionine and lysine are essential nutrients and are the first and second limiting amino acids respectively for dairy cows. Methionine tends to be more commonly deficient in both milking and dry cow rations while lysine requirements are usually met. The target is for the lysine:methionine ratio to be around 2.8-3:1 for dry cows.

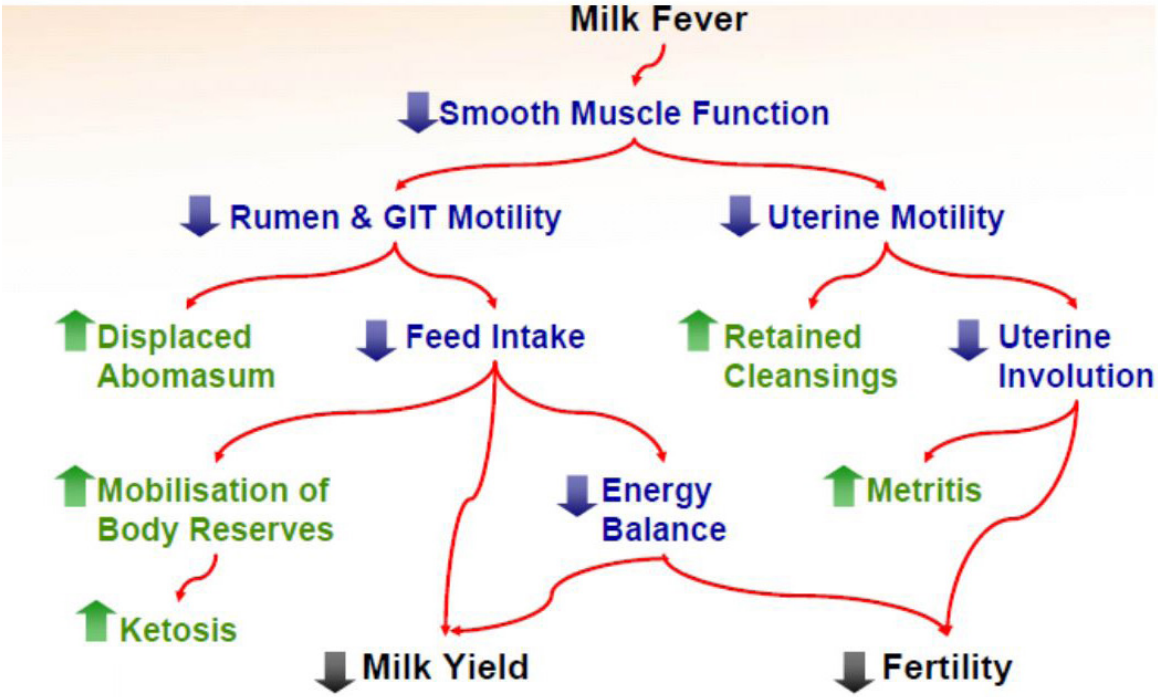
Supplementation with methionine should be targeted during the last three weeks of the dry period due to reduced dry matter intake, colostrum synthesis and foetal growth. Apart from the demand for colostrum production and the growing foetus, methionine has many other functions and so supplementation can benefit the health and performance of cows around the transition period:

- Methionine improves liver function by helping export fat out of the liver, reducing the risk of fatty liver.
- It has a role in enzyme and hormone formation.
- Cows supplemented with rumen protected methionine show higher albumin levels. This benefits the immune system by reducing oxidative stress and the impact of inflammation.
- It has a role in energy utilisation by improving levels of carnitine.
- Methionine increases phagocytic activity of white blood cells, enhancing health and immunity.

Nutritional Strategies for Milk Fever Prevention

Milk fever is caused by low blood calcium levels and is sometimes called a “gateway” disease, as a cow with milk fever has a much higher chance of developing other health issues (see Figure 1 below). Calcium is important for smooth muscle contraction, and so ensuring adequate blood calcium status also helps reduce the risk of slow calvings and retained foetal membranes.

Figure 2. The milk fever cascade.



The aim of nutritional strategies to prevent milk fever centre around stimulating the cow’s own hormonal mechanisms to release calcium from bones to raise blood calcium levels. This can be achieved in different ways:

- Feeding a low calcium diet.
- Use of anionic salts to induce a metabolic acidosis (partial and full DCAB system).
- Using a calcium binder to block calcium absorption, mimicking the low calcium approach.

Low calcium diet

This is perhaps the most common approach and relies on feeding forages with a low calcium content. Therefore, grass silage should not make up the bulk of the forage, as the calcium content of grass silage can be extremely variable and often higher than desired for dry cows. Wholecrop forages, maize silage and straw inclusion suit the low calcium system as these forages typically contain much less calcium than grass silage. Mineral supplementation with a specific dry cow mineral should contain no or very low calcium (<2%) and high magnesium, ideally over 20% (targeting a dietary magnesium content of 0.4-0.45% DM). For typical low calcium diets to control milk fever, the diet must supply no more than 30g of calcium per day.

Partial and Full DCAB System (Dietary Cation-Anion Balance)

An alternative to the low calcium approach is to follow a partial or full DCAB strategy using anionic salts. DCAB refers to the balance of positively charged (potassium and sodium) cations and negatively charged (chloride and sulphur) anions in the diet. Examples of commonly used anionic salts include magnesium chloride, calcium chloride and calcium sulphate (gypsum). Anionic salts acidify the cow’s blood, creating a metabolic acidosis to which she responds by increasing calcium mobilisation from bones, thereby raising blood calcium levels. A full DCAB diet is more acidic (and contains more anionic salts than a partial DCAB diet) and is more suited to higher yielding herds, which are more at risk of milk fever.

While the full DACB strategy tends to be more effective for milk fever prevention, it requires very careful management and monitoring of urine pH to ensure that cows are not too “acidic”. Aim for a urine pH 6.0 to 6.5 for Holsteins and pH 5.5 to 6.0 for Jerseys with the full DCAB system. If urine pH is less than 5.5, anionic salt intake is too high and could reduce dry matter intake, potentially predisposing cows to a displaced abomasum, along with kidney problems from acidity overload. Ideally 80% of cows tested should have a urine pH within the target range. When starting anionic salt supplementation, monitor four to six cows frequently from the start. Within a group uniform acidification takes three to five days and if there is a wide spread of urine pH’s in a group there could be a ration sorting issue. Urine pH should not be affected with partial DCAB diets.

Anionic salts are also unpalatable and when fed at high levels can reduce DMI. While a partial DCAB ration can be fed for the whole of the dry period, the full DCAB option is only recommended for the last three weeks before calving.

Regular forage mineral analysis is essential to assess mineral supply and how much anionic salts are required to achieve the target DCAB level. This is especially important when forages change. Low potassium forages are important to keep the DCAB below a target level and this can be difficult to achieve where slurry and potash are applied to grassland. Potassium in the diet should be less than 1.4% DM. Take nutritional advice on DCAB strategies for milk fever control as the mineral balance in the diet is crucial to its success. For more information on how to calculate DCAB please visit: https://ovc.uoguelph.ca/ruminant_health_management/sites/default/files/files/Dietary%20Cation-Anion%20Difference%20(DCAD).pdf

Calcium Binder

A calcium binder is a synthetic zeolite clay which binds to calcium, reducing its absorption in the small intestine so that it passes out through the faeces. This effectively results in feeding a low calcium diet as very little calcium is absorbed into the bloodstream. This stimulates the cow’s hormonal mechanisms to release calcium from the skeleton. Calcium binders have also been proven to increase feed intakes and energy status post-calving. A calcium binder is a useful approach if other strategies for milk fever control are struggling to keep the incidence below 5%.

The mineral content of the diet is still important to balance through supplementation but the calcium and potassium levels in the forages (as well as the DCAB value) are much less of a concern and should not affect how well the binder works. Therefore, forages that were thought to be unsuitable for dry cows can still be fed successfully with this approach. The binder will also substitute for calcium boluses. It is still important to maintain a magnesium content of 0.4-0.45% DM.

Calcium binders can also affect phosphorus availability so adequate levels must be included in the dry cow ration (0.35-0.38% DM). At the same time, do not oversupply phosphorus, which can induce milk fever at high levels.

Care must be taken not to feed the binder once the cow has calved as this can lead to milk fever. It should only be fed 14-21 days before calving and so only suits herds that separate their far-off and close-up cows for feeding.

Regardless of the feeding strategy for dry cows, once the cow has calved, the milking ration should be offered as soon as possible for the cow to achieve a high calcium intake.

Trace Element and Vitamin Requirements

The recommendations for trace elements and vitamins for dry dairy cows have been recently reviewed and updated by NASEM (National Academies of Sciences, Engineering and Medicine) in 2021 and are as follows:

Table 1. Predicted nutrient concentrations on a dry matter basis, required to meet trace mineral and vitamin requirements for dry dairy cows (Source: NASEM 2021).

Nutrient	Far-Off Dry Cow	Close-Up Dry Cow (< 21 days)
Trace element *(mg/kg DM)*		
Copper	17	19
Cobalt	0.2	0.2
Manganese	30.6	15.7
Zinc	29.3	30.0
Iodine	0.54	0.63
Selenium	0.3	0.3
Vitamin *(iu/day)*		
Vitamin A	81,400	81,400
Vitamin D	22,200	22,200
Vitamin E	1,184	2,220

Requirements based on a 740kg Holstein cow with a dry matter intake of 14.5kg in the far-off period and 12.5kg DMI in the close-up period.

While all trace elements and vitamins have roles to play in health and immunity, vitamin E is of particular importance during the dry period due to its antioxidant properties. Cows are naturally immunosuppressed around calving time and vitamin E levels in blood can dip by about 50%.

Ration Presentation

When feeding a total mixed ration to dry cows, feed presentation is very important to ensure that cows cannot sort the ration and select preferred elements of the diet. The chop length of forages must be short enough (<5cm long) so that the ration is eaten as formulated. The dry matter of the ration also has an impact on the ability of cows to sort and should be in the region of 45% dry matter. If higher, the addition of water can help to reduce sorting and encourage intakes. Feed must be fresh, with waste removed daily to avoid heating and spoilage.

Summary

Dry cow nutrition is crucial to a successful calving, subsequent milking performance and fertility. Forage quality must be assessed so that rations can be balanced to meet both protein and energy requirements while maintaining body condition score. The mineral balance is also important to consider as this can influence the incidence of milk fever. There are various options for milk fever control depending on forage quality, with DCAB strategies or calcium binders proven to be effective where the low calcium approach is not successful in keeping milk fever cases below the target of <5%.

Additional Resources

Dairy Herd Management (www.fas.scot)

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