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Preventative Feeding of the Dairy Cow in Transition

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The transition period in the lactating dairy cow is characterized by decreased feed intake that starts late in the close-up period and recovers several days after calving. This drop in intake results in an imbalance between required and absorbed nutrients. Other factors that are related to the volume and physical form of the feed can lead to problems frequently observed at calving time. In general, the veterinary diagnosis is based upon clinical symptoms of certain ailments. For greater chances of success and decreased treatment costs, it’s necessary to detect these ailments during their subclinical stage, or, better yet, to prevent their occurrence.

Some problems observed around calving time:
- distocia
- paralysis due to nerve pinching
- retained membranes
- metritis
- edema

Metabolic problems and their complications:
- hypocalcemia
- fatty liver/ketosis
- acidosis
- displaced abomasum
- laminitis

There are cattle management aspects particular to each dairy that can determine or even amplify these nutritional problems. In dairy farms that have less labor available, grouping cows by production is generally difficult to justify, particularly from a practical economic perspective. Fresh cows are often grouped together with high-producing cows, and first and older lactation cows are mixed in one group. This leads to cows that have recently calved and are thus still hurting, and with lower feed intake, competing for feed with other well-established, dominating cows. Also, dry cows do not generate money and are oftentimes seen as an economic burden for the cows in production, which generate immediate income. Many times, far-off dry cows will be placed in a group where they are offered the dairy’s worst quality feedstuffs (moldy feed, silage discards). Although feeding poor-quality feedstuff is a serious problem that is generally avoided for close-up cows, far-off cows are affected by involution of the rumen papillae, which takes a certain amount of time to return to normal.

To prevent nutritional problems around calving:
1. Prepare the rumen for the lactating diet.
3. Strengthen the immune system.

1. Prepare the rumen for the lactating diet.
   The time elapsed between the last three weeks of the dry period and the first two weeks after calving is known as the transition period. A proper preparation of the rumen is very important to help cows with the transition to the rigors of lactation. When the rumen has not been adequately prepared, there are different complications that can be observed. The three more frequent complications are as follows:
   - acidosis (clinical/subclinical)
   - laminitis
   - displaced abomasum

   Onset of any of the above after calving often leads to metabolic problems and is manifested as fatty liver and ketosis.

Site of digestion
   Digestion of feed in dairy cows occurs in three locations: rumen, abomasum, and intestines. Most of the sugars and starches are rapidly degraded in the rumen. Protein degradation is also potentially high in this organ, depending on the characteristics of the protein. Fiber is severely degraded in the rumen, with some fermentation taking place in the large intestine (mostly in the cecum). The small intestine is the main absorption site for amino acids, sugars, starches, and fats. In the large intestine, some fermentation of proteins, fiber, and some starch and sugars that have escaped rumen degradation takes place, although absorption is mostly limited to gases produced and to water. The integrity of the rumen
The cow’s ultimate goal is to reduce the particle size to speed up fermentation, accelerate passage of digested particles through the digestive system to increase rumen capacity, and, as a result, allow more feed to enter the rumen.

The saliva secreted while the animal chews its food buffers the acidity (saliva is rich in sodium bicarbonate) that is produced due to feed fermentation in the rumen. When the feed particle size/effective fiber is not adequate, or when the amount of starch/sugars fermented in the rumen exceeds the supply of bicarbonate from the saliva, the final outcome is acidosis. Sometimes, compensatory mechanisms cannot cope completely with the acid build-up in the rumen. In this initial stage, also known as “subclinical acidosis,” there are some subtle and non-specific signs that can be looked for in the cow. Some of the changes that occur during subclinical acidosis:

- reduction in rumen pH
- from slightly increased rumen movements to none at all (atony)
- reduction in ruminating activity
- great variation in daily feed intake (5–10%)

Manure during subclinical acidosis will be characterized by the following:

- firm to loose in the same group
- the presence of bubbles
- mucus/fibrin casts
- larger fiber particles (undigested stems)
- undigested grain

When there is not enough effective fiber (NDFe) in the diet, fiber particles in the manure are usually larger; the reason for this is that the rumen mat slows the rate of passage of material through the rumen. In the absence of sufficient long forage particles (e.g., hay, long silage particles, etc.), this mat is not formed adequately and some larger forage particles are allowed to leave the rumen without being digested. The presence of whole grain in the manure can result from other management issues, including corn silage that’s overly dry or insufficient grinding of the grain.

The increase in the rate of passage in acidosis is related to smaller than normal fiber particles present in the rumen that cannot form a mat to slow the passage of feed. The diarrhea observed with acidosis occurs due to excessive fermentation in the large intestine, where acid production produces foam or bubbles that will show up in the manure. This cycle perpetuates itself as the greater acidity damages the rumen papillae that are in charge of absorbing the free acids; this in turn decreases the absorption of acids, allowing for their build-up and even greater acidity. It is this acidity that leads to inflammation of the epithelium of the rumen walls (rumenitis), abscesses in the liver, and damage of the lungs and blood vessels.

If subclinical acidosis proceeds undetected, it will lead to rumen acidosis and its typical signs: off-feed, laminginitis, and protein/fat inversion in milk (this one can also be seen in the first stages of the subclinical acidosis). Causes of clinical acidosis are too much grain in the diet (or grain with greater starch fermentability in the rumen – e.g., wheat), highly digestible forages, and/or reduced effective fiber due to finely chopped forages. Other management aspects that may decrease particle size of the overall diet include animal sorting behavior, inadequate bunk space, and increased mixing time. The overall general consequence of the above causes is a greater production of lactic acid. Liver abscesses, which are characteristic of clinical acidosis, result from damage to the rumen epithelium that leads to a bacterial invasion that colonizes organs (including the liver, which acts as the first filter...
for blood arriving from the digestive system). Later, bacteria are disseminated to the lungs, where they rupture blood vessels and create complications of acidosis such as pneumonia and sporadic bleeding through the nasal orifices.

Maintaining an adequate concentration of calcium in the blood during the transition period of the dairy cow is very important. With slight drops in blood calcium concentration there is a reduction in feed intake, decreased smooth muscle (internal organs) tone, and increased incidence of retained fetal membranes, displaced abomasum, and mastitis.

A critical step to maintain an adequate blood calcium level is to achieve an equilibrium of positive and negative ions. The balance between cations (positive charge) and anions (negative charge) should tend to neutrality. When considering close-up cow diets, it is recommended that the dietary ionic balance be negative (more anions than cations) because a negative balance leads to calcium mobilization and absorption, which is one of the most frequent problems in the transition dairy cow. The anion and cation concentration in feeds is variable. In certain forages (e.g., alfalfa), the concentration of potassium (cation, positive charge) is very high, and its inclusion in the diet will turn the overall ionic charge to the positive side, interfering with the normal metabolism and absorption of calcium around calving time. This is the reason why hypocalcemia (calcium deficiency in blood) is oftentimes referred to as “hyperpotassemia” (excess potassium in blood).

The other elements that participate in this equilibrium are sodium (Na), chlorine (Cl), and sulfur (S), with the last two supplying the bulk of the negative charges in the diet. Of the feeds that are most commonly used in the diet of dairy cows, positively charged elements are predominant over negatively charged elements. A positive balance is desirable when we are dealing with cows during lactation, but it becomes a problem in cows during the transition period before calving. Calculations to determine the ionic balance (DCAD) are as follows:

\[
\text{DCAD (milliequivalents/100 grams) dietary DM} = \\
\left[\frac{\%\text{Na in DM}}{0.023} + \frac{\%\text{K in DM}}{0.039}\right] - \left[\frac{\%\text{Cl in DM}}{0.0355} + \frac{\%\text{S in DM}}{0.016}\right] 
\]

To monitor the success of administering acidogenic diets, one can check the urine pH of five or six cows during the last week before calving. The cows should have been fed an acidogenic diet for over 24 hours prior to testing the urine. The pH of the urine should be between 5.5 to 6.5 in order to ensure a metabolic acidosis that will protect the cow from hypocalcemia and milk fever.

3. Strengthening the immune system.
The hormonal changes that occur around calving time (estrogens and corticosteroids) provoke a reduced ability of leucocytes to fight infections. It is for this reason that there’s an increased susceptibility to mastitis and metritis. To prevent an increased incidence of infectious disease, it is important that there be adequate nutritional management. Preventing low blood calcium, for example, helps because during hypocalcemia cortisol secretion increases, which compromises the immune response. One way to improve immunity is by supplementing selenium (3 mg/d). It is also helpful to administer 1000 IU/d of vitamin E and supplementary amounts of copper (100 mg/d) and zinc (400 mg/d), while providing a diet that supplies the requirement for protein and energy of the cow (3.5 pounds of protein and 0.73 Mcal of NEI per pound of feed).

Nutritional strategies to minimize problems during the transition period
1. Feed a diet with adequate protein/energy during the 3 to 4 weeks before calving to
   • minimize mobilization of fat stores
   • adapt microbes and stimulate development of rumen papillae
   • maintain effective fiber
   • maintain a reasonable feed intake.

Monitor the following:
   • manure consistency
   • rumination frequency
   • production post-calving

2. General management rules:
   • Minimize regrouping or movement of animals prior to calving.
   • With cows having a condition score greater than 3.5, decrease energy intake but maintain weight.
   • When body condition is less than 3.25 in far-off dry cows, start feeding the close-up diet to improve condition.
   • First lactation cows: bring them to the close-up group 4 to 5 weeks before calving.
   • Second lactation and older cows: bring them to the close-up group 3 to 4 weeks before calving.
   • Ideal: group first lactation and older cows separately.
   • Ensure that there is enough bunk space.

3. Fresh cows:
   • Feed a diet rich in protein and energy and with adequate effective fiber.
   • Transition of first lactation cows to lactation diet: 2 to 4 weeks.
   • Transition of second lactation and older cows to lactation diet: 2 weeks.
   • Cows with problems must regain feed intake before returning them to the high production diet.

Most of the problems of the transition dairy cow can be prevented by taking into consideration the interaction between management, nutrition, and health. Most of the clinical ailments of the dairy cow result directly or indirectly from inadequate nutritional management. Although these problems may show up during different stages of the lactation, it is around calving where they are observed more frequently. In order to decrease their incidence, it is important to maintain an adequate rumen function.