Transition nutrition – Beginning the discussion

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Abstract

Veterinarians and nutritionists should discuss diet formulation, feeding management, and health issues regarding transition cows with one another to help dairy herd managers achieve their goals. By working together and providing different perspectives and experiences, they can help identify areas of opportunity or provide solutions to problems in the transition program. Some areas of transition nutrition to focus on, based on recent research, include intake of fermentable carbohydrates, physically effective fiber, and energy and supply of metabolizable protein and limiting amino acids. Too frequently, transition nutrition failures result from poor delivery of the formulated diet(s) or non-nutritional stressors such as overcrowding, inappropriate moving or grouping of cows, or environmental stress. Veterinarians and nutritionists working together should be able to help motivate farmers to make management changes to achieve transition goals.

Key words: dairy, nutrition, transition, feeding

Résumé

Les vétérinaires et les nutritionnistes devraient discuter entre eux de la ration, de la régie de l'alimentation et des enjeux de santé chez les vaches en période de transition afin d'aider les gestionnaires de troupeaux laitiers à atteindre leurs objectifs. En travaillant de concert et en fournissant leurs perspectives et expériences respectives, ils peuvent identifier des secteurs offrant des possibilités ou promouvoir des solutions aux problèmes dans les programmes de transition. Sur la base de travaux récents, plusieurs aspects de la nutrition durant le période de transition méritent plus d'attention incluant la prise alimentaire de glucides fermentescibles et de fibres efficaces, l'énergie et l'approvisionnement en protéines métabolisables et les acides aminés limitants. Il arrive trop souvent que l'échec des programmes d'alimentation durant la période de transition soit causé par une mauvaise livraison de la ration spécialement formulée, par des agresseurs non-nutritionnels comme l'entassement et le déplacement ou le regroupement inadéquat de vaches, ou par des pressions de l'environnement. Les vétérinaires et les nutritionnistes travaillant de concert devraient pouvoir motiver les éleveurs à apporter les changements nécessaires à la gestion pour rencontrer les objectifs de la période de transition.

Introduction

Feeding and management practices for transition cows can have a substantial impact on cow well-being and dairy herd profitability. In addition, "effective communication between a dairy herd's advisers can greatly enhance its performance".[9] A dairy herd's veterinarian and nutritionist play key roles in helping to achieve transition success when they have a positive relationship that promotes open discussion. There are 3 primary components to a successful relationship between the veterinarian and nutritionist. First, they must take a team approach to meet the dairy herd's goals. The emphasis should be on working together to solve problems and identify areas of opportunity while avoiding pointing fingers and placing blame. Second, they must communicate regularly through formal dairy team meetings, informally by phone and email, or in person. Third, they must learn to continuously promote discussion and motivate change. It is critical to realize that areas of knowledge and expertise can overlap, but the perspectives can be different and result in unique and effective solutions to common problems.

The goal for this presentation and manuscript is to provide veterinarians with information regarding key topics and issues in transition-cow nutrition that are being addressed by nutritionists, thus allowing a veterinarian to start a discussion with the farmer and the dairy herd's nutritionist to identify areas of opportunity or solve existing problems.

No "One-Size-Fits-All" Approach to Transition Nutrition

The transition period is typically defined as -3 to +3 weeks relative to calving. However, the farmer needs to manage the transition period before the close-up period and possibly before dry-off to ensure appropriate dry matter intake and nutrient supply which will impact body condition score and metabolic health. There is no "one-size-fits-all" approach to transition nutrition because the interaction of nutrition, environment, and management is unique for every dairy herd. However, there are some common themes. Far-off, close-up, fresh, and high diets should be formulated in the context of each other. Smooth nutrient changes are desired. For example, suboptimal transitions from the close-up diet to the fresh-cow diet can decrease milk yield, lactation persistency, and reproductive performance. During the dry period, it is important to maintain dry matter intake and optimize nutrient (e.g. energy, amino acids, and minerals) supply while supporting immune function and minimizing environmental and social stressors. During the lactation period, it is important to promote a rapid increase in dry matter intake while giving attention to fermentable carbohydrate source and amount to provide sufficient energy and microbial protein and promote rumen health. The duration and severity of negative energy and protein balance must be managed to promote lactational performance, reproduction, and health. The use of a fresh cow group and diet for 2 to 3 weeks after calving is recommended. The fresh-cow diet should be formulated within the context of the dry and high group diets. The fresh diet should not exceed ~25% starch or the amount that will be fed in the high group, should avoid inclusion of highly fermentable starch sources, and provide adequate physically effective fiber to maximize dry matter intake and minimize ruminal acidosis. After the fresh period when serum nonesterified fatty acids and beta-hydroxybutryrate are lower, the diet should contain highly digestible carbohydrates to maximize dry matter intake and milk production. Both the fresh and high diets should provide high-quality rumen undegradable protein sources and include rumen-protected amino acids as needed to optimize the amino acid profile.

A simple but often difficult question to answer on many dairy herds is "how much total mixed ration (TMR) are the cows eating?". This is an area where veterinarians need to work with nutritionists to motivate farmers to measure dry matter intake for both dry and lactating cows. Dry matter intake is a critical piece of information when formulating diets and troubleshooting transition failures. In situations where dry matter intake is too low (e.g. 1600 lb (727 kg) Holstein dry cows eating ~26 to 28 lb (11.8 to 16.2 kg)/day), feeds should be tested for chemical composition and digestibility of fiber and starch. Gut fill because of poorly digestible forages is commonly a cause of low dry matter intake. Also, feed bunk management should be evaluated, with particular attention given to feed availability. Non-nutritional stressors, such as stocking density, cow movements, and temperature humidity index should be evaluated. In contrast, in situations where dry matter intake is too high (e.g. 1600 lb (727 kg) Holstein eating more than 33 lb (15 kg)/day) then limiting grain-type forages (i.e. corn silage) and other nutrient-dense feeds to control intake is needed. Use of consistent, palatable, low-potassium, bulky forage such as straw is effective.

Energy and Fermentable Carbohydrates

There is a substantial body of evidence to demonstrate that manipulation of the dry diet(s) can have a substantial impact on subsequent health and lactational performance. In regard to energy, excessive intake may predispose cows to greater tissue insulin insensitivity, greater fat mobilization, and increased risk of metabolic disorders. Currently, controlled-energy dry cow diets are recommended for use in the far-off and close-up periods in a 2-group management system or in a 1-group management system. The goal is to provide sufficient energy to meet daily needs while not over-supplying energy intake relative to requirements. Cows will easily consume more than 150% of their energy requirement on corn-silage based diets. Typically, this is too much energy. The controlled-energy diets often incorporate low-energy feedstuffs (e.g. straw, grass hay, or haycrop silage). Inclusion of these feedstuffs allows cows to consume feed ad libitum without over-consuming energy. The cows eat to gut fill. A common pitfall in controlled-energy diets is incorporating straw or hay without processing the feed to reduce particle size. Large or excessive particle size can lead to sorting against longer forage particles, which can accentuate excessive energy intake. Ideally, the straw or hay should be processed so that it is ≤2 inches (5 cm) or ~1/3, 1/3, and 1/3 on the screens of the Penn State Particle Separator.

Recently, the effect of energy intake during the dry period on blood metabolites and reproductive performance in the subsequent lactation was evaluated using pooled data from 7 studies conducted at the University of Illinois.[3] The treatments applied during the dry period were categorized as either controlled-energy (≤ 100% of NE_L requirement; ~12 Mcal/day) or high-energy (>100% of NE_L requirement; ~20 Mcal/day). Holstein cows used in the analysis averaged 77 lb (34.9 kg) of milk and 1,335 lb (607 kg) of body weight at 4 weeks in lactation. Dry matter intake during the first 4 weeks of lactation tended to be lower for cows fed the high-energy diets than the controlled-energy diets (33.9 vs 36.3 lb (15.4 vs 16.5 kg), respectively). Far-off energy intake did not affect days to pregnancy. However, cows fed high-energy diets rather than controlled-energy diets during the close-up period had a significantly longer time to pregnancy (167 vs 157 days). Interestingly, the cows fed high-energy diets lost more body condition during the first 6 weeks of lactation and had greater nonesterified fatty acid concentrations at week 1 of lactation. In another study,[7] non-lactating, non-pregnant cows offered a high-energy diet compared with a controlled-energy diet for 2 months had greater body weight and increased omental, mesenteric, and perirenal adipose tissue masses without significant differences in body condition score. The results indicated that body condition score may not be sensitive enough over the short term of a dry period to detect changes in internal fat stores that can affect metabolism and health during the transition period.

The controlled-energy dry diet approach has been successful in some, but not all dairies. Some failures may be attributed to a change to an inappropriate fresh-cow diet. Unfortunately, there is limited research data with fresh diets, especially following a controlled-energy diet fed for a 60-or 40-day dry period. Recently at Miner Institute, 72 multiparous Holstein cows were used to evaluate the effect of dietary starch content in corn silage-based diets fed in early lactation on performance and blood metabolites following a shortened (40 day) dry period where a controlled-energy diet was fed. Typically, controlled-energy dry diets contain between 12 and 16% starch on a dry-matter basis, which is much less than lactation diets (e.g. ≥23% starch) typically used in the Northeast or Midwest US. A phase feeding or step-up approach to feeding during the prepartum and postpartum periods is often recommended, but the optimal increase in starch from a controlled-energy dry diet to a lactation diet is unknown.

Dietary treatments (Table 1) were 1) a low-starch diet (21.0%) for the first 91 days-in-milk (LL), 2) a medium-starch diet (23.2%) for first 21 DIM and a high-starch diet (25.5%) for the next 70 DIM (MH), and 3) a high-starch diet (25.5%) for the first 91 DIM (HH). Corn meal was replaced partially with soyhulls and wheat middlings in the low and medium diets. The use of the terms low, medium, and high starch are relative for this study, and do not necessarily reflect the range of starch fed throughout the US. Lactational performance is summarized in Table 2. During the first 91 DIM, dry matter intake tended to be higher for cows fed LL than cows fed HH; cows fed MH were intermediate. During the first 21 DIM, cows fed M consumed similar starch and rumen fermentable starch as cows fed L. However, when the MH cows were fed the higher starch diet after 21 DIM, they consumed more starch and rumen-fermentable starch than LL cows. The cows fed MH had higher milk yield than cows fed HH, indicating the benefit of a step-up feeding approach for starch when a controlled-energy dry diet is used. Cows fed LL had higher milk urea nitrogen than cows fed MH and HH, indicating less efficient use of nitrogen, presumably due to less rumen fermentable starch intake and (or) excess dietary crude protein intake. Milk nitrogen efficiency was highest for cows fed MH because of high milk true protein yield and intermediate crude protein intake relative to the other treatments. Lipid mobilization to support negative energy balance was not compromised based on acceptable losses of body weight and body condition, and concentrations of serum nonesterified fatty acids and β-hydroxybutyrate. Serum nonesterified fatty acids tended to be higher for cows fed MH than cows fed LL or HH.

Table 1. Ingredient and analyzed chemical composition of low-, medium-, and high-starch diets fed to early lactation Holstein cows.

Item	Low	Medium	High
Ingredients, % of DM			
Corn silage	34.6	34.6	34.6
Haylage	11.4	11.7	11.4
Wheat straw	4.1	4.1	4.1
Corn meal	6.9	11.1	16.7
Soybean meal	11.4	11.9	11.9
Soybean hulls	9.7	6.5	3.2
Wheat middlings	6.1	3.9	1.8
Canola meal	3.1	6.1	6.1
AminoPlus	2.5	-	-
Other	10.2	10.1	10.2
Chemical composition			
DM, %	49.5	50.1	49.6
CP, %	17.3	17.0	16.7
NDF, %	35.7	33.9	31.9
Sugar, %	6.1	5.8	5.9
Starch, %	21.0	23.2	25.5
Rumen fermentable starch, %	16.8	18.9	20.2
Digestibility			
24-h NDF, % NDF	58.4	57.3	54.0
7-h starch, % starch	76.5	76.7	74.5

This study demonstrated that lower-starch (≤23%) diets can support lactational performance following a controlled-energy dry diet. The step-up diet approach (MH) may be preferred over the 1-group diet approach (LL and HH) because of improvements in nutrient use (i.e. milk nitrogen efficiency). However, the 1-group lactation diet approach (LL) may be preferred when energy from corn starch is expensive relative to energy from non-forage fiber sources, or when a facility does not have the ability to have 2 groups in early lactation.

Large changes in dietary composition and intake during the transition period may increase the susceptibility of cows to subacute ruminal acidosis (SARA).[18] This may help explain the results of the Miner Institute study described above. In a follow-up study conducted at Miner Institute, fresh cows fed higher starch (27.5% vs 21.0%) after being fed a lower-starch (15.5%) close-up diet experienced more SARA in the first week of lactation. Interestingly, SARA has been identified as causing inflammation.[18] Low ruminal pH can result in the death and lysis of gram-negative bacteria that are in the rumen, thereby increasing the free-bacterial endotoxin, lipopolysaccharide (LPS), in the rumen. Normally, the epithelium of the rumen acts as a barrier to prevent LPS

Table 2. Lactational performance for the first 91 days-in-milk.

	Dietary treatment				
Item	LL	MH	HH	SE	*P*-value
DMI, kg/d	25.2[x]	24.9[xy]	23.7[y]	0.5	0.06
Starch intake, kg/d	5.3[b]	6.3[a]	6.1[a]	0.1	<0.001
Rumen fermentable starch, kg/d	4.4[b]	5.2[a]	5.0[a]	0.1	<0.001
Neutral detergent fiber intake, kg/d	9.0[a]	8.1[b]	7.6[b]	0.2	<0.001
Sugar intake, kg/d	1.5[a]	1.5[ab]	1.4[b]	<0.1	0.02
Milk, kg/d	47.9[ab]	49.9[a]	44.2[b]	1.6	0.04
3.5% Fat-corrected milk, kg/d	51.9	52.2	47.4	1.7	0.09
Solids-corrected milk, kg/d	47.4	47.9	43.5	1.5	0.09
Fat, %	3.88[x]	3.64[y]	3.79[xy]	0.08	0.08
True protein, %	2.90	2.92	2.97	0.04	0.52
Milk urea nitrogen, mg/dL	15.2[a]	12.7[b]	11.9[b]	0.3	<0.001
Milk/DMI, kg/kg	1.92	2.02	1.87	0.06	0.18
Milk nitrogen efficiency, %	34.2[b]	37.6[a]	35.6[ab]	0.7	0.005
Body weight, kg	681	682	682	12	0.99
Body condition score	3.13	3.04	3.16	0.07	0.46
Serum NEFA, µEq/L (1-21 DIM)	452[aby]	577[ax]	431[by]	43	0.03
Serum BHBA, mg/dL (1-21 DIM)	9.3	8.8	7.8	1.1	0.15

[ab] Least squares means within a row without a common superscript differ ($P \leq 0.05$).
[xy] Least squares means within a row without a common superscript differ ($P \leq 0.10$).

entry into the blood circulation or the lymphatic system. The acidic ruminal environment, changes in osmotic pressure, and ruminal LPS can damage the epithelium and allow the LPS to translocate into the bloodstream. The presence of LPS in the bloodstream stimulates an acute-phase response that results in the production of pro-inflammatory cytokines, acute-phase proteins, and systemic inflammation.

The activation of the acute-phase response is viewed as a protective reaction to reestablish the disturbed homeostasis.[18] However, the presence of inflammation over long periods may be associated with negative consequences for the cow, especially the transition cow. Prolonged systemic inflammation can 1) cause significant changes in the energy and lipid metabolism, 2) lead to the development of refractory states associated with immune suppression and increased susceptibility to various diseases, and 3) increase the cow's requirements in energy and nutrients, thereby lowering the efficiency of energy and feed use by the cow.[18] The characterization of SARA and development of feeding strategies for its prevention have been the focus of research for many years. However, most research has been focused on mid-lactation cows, with little attention given to transition cows.

Metabolizable Protein and Amino Acids – An Opportunity

The notion that protein nutrition of the dry cow influences lactational performance and health is widespread.[5] Many studies have focused on crude protein needs of dry cows, but the results have been mixed with several studies finding little response in milk yield, milk protein content, or milk protein yield.[1] Part of the inconsistency in results lies in the poor relationship between crude protein intake and metabolizable protein supply in dry cows. The relationship is dependent on quality and quantity of dietary protein and availability of fermentable carbohydrates for microbial growth in the rumen. Improvements in models for diet formulation (i.e. CPM Dairy Software and Cornell Net Carbohydrate and Protein System (CNCPS)) have made it possible to estimate metabolizable protein supply and needs of dry cows. Although models provide estimates of metabolizable protein and amino acid supply, the use of crude protein for diet formulation is still prevalent. Currently, formulating diets for dry cows in regards to metabolizable protein and amino acids is an area of opportunity.

Recommendations for metabolizable protein for mature dry cows are typically in the 1000 to 1200 g/day range.[2,6] Diets lower in fermentable carbohydrates, particularly starch, may need to be supplemented with rumen undergradable protein (e.g. soy products) to provide the appropriate amount of metabolizable protein and proper amino acid profile. French[8] conducted a literature review of published studies with dry cows and protein nutrition and generated a database that contained 12 published studies, 30 treatments, and 382 animals. Descriptions of rations and cows were modeled

Table 3. Guidelines for starch in corn silage-based diets (personal communication C. Sniffen).

Group	Starch in ration, %DM	Fermentable starch, %starch 7h	Fermentable starch, %DM	Fermentable starch, % total fermentable CHO
Close-up	16 to 18	80	12.8 to 14.4	34
Fresh cows, 0 to 21 DIM	21 to 25	74	16.3 to 18.5	44
Early/mid-cows, 21 to 150 DIM	25 to 30	83	20.7 to 24.9	57
Late cows, > 150 DIM	18 to 22	74	13.3 to 16.3	37

in CNCPS to generate metabolizable protein values. Metabolizable protein fed in the close-up period was positively related to milk protein yield in early lactation as long as cows were fed >75% of their metabolizable protein requirement in early lactation. Based on the database, French suggested the following guidelines for feeding close-up cows: 1300 g/day of metabolizable protein, 30 g/day of metabolizable protein-methionine, and 90 g/day of metabolizable protein-lysine. Recent field experiences with diets providing 1300 to 1400 g/day of metabolizable protein while balancing for methionine and lysine are supporting excellent transition performance. Supplementing amino acids (i.e. methionine or lysine) during the dry period and early lactation are showing positive results on milk yield,[14,17] milk protein content,[11,12] and immune function assessed by leukocyte phagocytic activity.[12] Interestingly, the lactational response to supplemental amino acids depended on the ruminal degradablity of protein[17] and crude protein and metabolizable protein supply.[14] Lean and Van Saun[10] suggested that prepartum diets containing more protein lessened the impact of dietary protein postpartum, whereas lower prepartum protein heightened the response to postpartum protein and amino acids.

Formulating diets to meet the cow's requirement for metabolizable protein in early lactation is challenging. The cow has an inability to consume sufficient protein to meet mammary and non-mammary amino acid requirements. Generally, negative protein balance is not considered as big of a concern as negative energy balance in early lactation. However, when cows are deficient in metabolizable protein, they will break down muscle and other protein sources in the body. A high-producing cow can mobilize up to 2.2 lb (1 kg) of tissue protein per day during the first 7 to 10 days after calving, when the protein balance is most negative. Within the first 5 to 6 weeks after calving, a high-producing cow can mobilize up to 46 lb (20.9 kg) of labile protein reserves. Many cows will return to positive protein balance between 3 and 6 weeks after calving. Although protein mobilization is necessary to contribute to the insufficient supply of energy and protein, excessive mobilization increases the risk of metabolic disorders, immune dysfunction, and poor lactational and reproductive performance.

Increasing dietary protein and metabolizable protein supply during late gestation will increase nitrogen retention in the maternal tissues of a cow[13]. The size of maternal protein reserves can affect protein mobilization during early lactation. More and more nutritionists are formulating close-up diets to supply 1200 to 1400 g of metabolizable protein per day while meeting, but not greatly exceeding, the energy requirement. Typically, that amount of metabolizable protein will prevent protein mobilization before calving when intake is low. This is critical, because mobilization of labile protein reserves before calving reduces the amount available after calving. In a recent study,[15] a large variation was observed among cows in the onset and duration of protein and energy mobilization during the transition period. Based on plasma 3-methylhistidine concentrations and muscle thickness profiles, protein mobilization started before calving and continued until week 4 of lactation. Interestingly, protein mobilization occurred before lipid mobilization in most cows. The authors speculated this might be due to a prepartum amino acid deficiency in the absence of negative energy balance. In addition, it appears the timing of protein mobilization is related to hyperketonemia. Cows with lower 3-methlyhistidine concentrations (indicating less muscle breakdown) had higher serum β-hydroxybutyrate concentrations. Greater protein mobilization to a certain extent after calving may provide amino acids for gluconeogenesis and limit ketogenesis. However, this hypothesis needs to be confirmed with additional research.

During lactation, use of lower crude protein diets to reduce economic and environmental costs of feeding excess nitrogen is increasing. There appears to be an opportunity to reduce dietary crude protein by 0.5 to 1.5 units while maintaining metabolizable protein supply on a herd basis, with minimal risk of lower milk production.[4] However, given the negative metabolizable protein balance that occurs following parturition, it is unclear if lower protein diets can be used successfully in very early lactation. Lower crude protein diets may increase the severity and duration of negative protein balance.

In a study at Miner Institute, multiparous Holstein cows (n = 84) were used to evaluate the effect of crude protein and metabolizable protein in corn silage-based diets fed during the fresh and early lactation periods on performance and metabolism. Treatments were 1) LL: a low crude protein diet (15.3%) for 13 weeks after calving; 2) HL: a high crude protein diet (H; 17.0%) for 3 weeks and then a switch to a low crude protein diet until 13 weeks after calving; and 3) HM: a H diet for 3 weeks and then a switch to a moderate crude protein diet (16.2%) until 13 weeks after calving. The metabolizable protein supply at 42 lb (19.1 kg) dry matter intake was estimated (NDS v3) to be 1798, 1895, and 1999 g/day for L, M, and H, respectively. Post-study modeling indicated metabolizable protein supply to be 2189, 2541, and 2538 g/day at 3 weeks for LL, HL, and HM, respectively, and 2599, 2650, and 2994 g/day at 13 weeks for LL, HL, and HM, respectively. Treatment did not affect dry matter intake, milk yield, or content of milk fat and true protein through 13 weeks (Table 4). As expected, crude protein intake and concentrations of milk urea nitrogen and blood urea nitrogen were highest for HM. Milk nitrogen efficiency was higher for LL than HM. Based on blood metabolites, muscle gene expression, and post-study modeling, the mobilization of labile protein reserves was not affected by treatment. These results suggest that mobilization of labile protein reserves is regulated primarily by hormonal changes, and is less responsive to the moderate changes in metabolizable protein supply in very early lactation. The negative protein balance was most negative during week 2 after calving. Early lactation diets can be formulated to contain less crude protein than traditionally fed by ~1.5 units and successfully support lactational performance when sufficient amounts of fermentable carbohydrates and rumen degradable protein are included to promote microbial growth. In addition, diets should provide high quality, rumen undegradable protein sources, and include rumen-protected amino acids as needed, to optimize the amino acid profile. It is unclear whether current protein feeding recommendations regarding metabolizable protein supply and amino acid profile optimizes immune function.

Table 4. Lactational performance results from calving to 13 weeks after calving.

Item	LL	HL	HM	SE
DMI, lb/d	57.6	57.6	58.3	0.9
CP intake, lb/d	8.6[b]	8.8[b]	9.7[a]	0.2
Milk, lb/d	112.6	110.4	115.3	2.6
SCM, lb/d	105.4	104.5	109.3	2.0
Fat, %	3.51	3.58	3.58	0.09
True protein, %	2.82	2.86	2.89	0.04
MUN, mg/dL	8.3[b]	9.0[b]	11.8[a]	0.2
BUN, mg/dL	8[c]	10[b]	12[a]	<1
SCM/DMI	1.90	1.91	1.98	0.04
Milk N efficiency, %	39.8[a]	38.6[ab]	36.9[b]	0.5

[abc] $P \leq 0.05$

Monitor Transition Nutrition and Health with Rumination

For years, farmers, nutritionists, and veterinarians have watched cows ruminate to assess health and nutrition programs. Most of the time, it was in response to a cow showing clinical signs of illness or benchmarking herd rumination by walking a pen of cows and assessing the percentage that are ruminating at a specific time. Recently, the adoption of activity and rumination monitoring systems for heat detection on-farm has changed the way that farmers and nutritionists collect and use rumination data. Rumination data can help manage cow health, since a drop in rumination typically occurs before a drop in milk or clinical signs appear. The transition period is a great opportunity to use changes in rumination to generate health reports for cows that need to be examined. Interestingly, many farmers are modifying or eliminating routine health exams for every fresh cow and instead focusing efforts on fresh cows that had low rumination time as a dry cow or cows that are not increasing in rumination time during the first 7 to 10 DIM. This can result in either tremendous labor savings or allow additional time to be spent with the highest-risk cows. Typically, dry cows will have a daily rumination time within 50 minutes of lactating cows. At calving, rumination time will drop by ~70%. Then, healthy fresh cows will increase rumination time by ~50 minutes per day until they reach peak rumination at ~7 to 10 DIM. During the first week of lactation, cows that eventually develop metabolic disorders or metritis often have lower rumination times than cows that remain healthy. Rumination time and its deviation are allowing farmers to identify high-risk cows for metabolic disorders, lameness, and mastitis 1 to 6 days before clinical signs are present. Also, some farmers and researchers are using rumination time to modify treatment protocols, assess efficacy of treatments, and make culling decisions.

In addition to monitoring rumination of individual cows, farmers are using rumination time to track groups or pens of cows to evaluate the nutritional program, management practices, standard operating procedure compliance, and facilities. The recommendation is to monitor the consistency of rumination time per day of the group that optimizes performance and welfare. Trying to achieve a particular number of minutes of rumination per group is the wrong goal to focus on. The optimal rumination time likely varies among groups and herds. However, in general cows will ruminate between 400 and 600 minutes per day. Swings in rumination time of 30 to 50 minutes should be identified and investigated for possible causes. Common causes include a dry matter change in an ingredient, an ingredient composition change, sorting, non-compliance with feed mixing and delivering protocols, and cow movements (regrouping). Another advantage of monitoring group rumination time is that it allows ration changes to be assessed immediately instead of waiting a few days or weeks to see a performance response or change in health.

Conclusions

Veterinarians and nutritionists need to build meaningful working relationships that help dairy herds achieve their goals. Discussion regarding transition nutrition and its implementation is encouraged. Topics should include measuring dry matter intake; formulating far-off, close-up, fresh, and high diets in the context of one another; controlling energy intake during the dry period to promote intake after calving; providing the correct balance of fermentable carbohydrates and physically effective fiber to support lactation performance and minimize subacute ruminal acidosis; and supplying sufficient metabolizable protein and limiting amino acids to minimize negative protein balance, maximize milk component yield, and support immune function.

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