Nutrition management in transition cows, what’s new?

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Take-Home Message

- Diets fed during the last few weeks of gestation and first few weeks of lactation can affect the health, production and profitability of cows for their entire lactation.
- Primary goals of late gestation diets are to prevent hypocalcemia (discussed in other papers), prevent a large drop in dry matter intake around parturition, and provide adequate nutrients to maintain good immune function and produce high quality colostrum.
- A substantial decrease in dry matter intake during the last week of gestation is a risk factor for fatty liver and ketosis. Feeding high fiber diets throughout the dry period so that energy intake matches energy requirements is key to maintaining intake during the prepartum period.
- Current requirements for metabolizable protein (MP) for prefresh cows are adequate, however prefresh heifers may benefit from additional MP.
- High concentrations of MP and supplemental rumen protected amino acids during the fresh period increases milk and milk component yields during the fresh period (first 3 or 4 weeks) and may result in increased yields of milk components for months after supplementation has ceased.
- Supplementation of palmitic acid during the fresh period substantially increases milk fat yield but at the expense of body condition. Delaying supplementation until week 4 of lactation gives almost the same response in milk fat yield with much smaller losses in body condition.
- Data are not available on effects of increased supplementation of trace minerals during the transition period, but because of body stores, positive responses are unlikely to increased supplementation.
- Because of colostrum synthesis and the oxidative stress of parturition, intake of vitamin E should be increased to at least 2000 IU/day during the prefresh period.
- Increased supplementation of vitamin A during the prefresh period may be useful but data on specific supplementation rates are lacking. Based on the amount of retinol secreted in colostrum, vitamin A supplementation during prefresh should be increased to about 85,000 IU/day.

Nutritional Management of Transition Cows

Transition cows are defined as those cows and heifers during the last 3 weeks of parturition and first 3 weeks of lactation. On most farms, cows are managed in groups and diets must be tailored to groups rather than individual cows. Factors other than the nutritional needs of cows must be considered when developing grouping (nutrition) systems for cows. Inadequate facilities and labor may eliminate any benefits associated with grouping cows and feeding the groups specific diets. Factors to consider when developing grouping systems include:

1) Are pens available that can properly house the animals? Prefresh cows are large and if free stalls are used they need to be larger than those used for lactating cows. The cows also need more room at the feed bunk. Recommended bunk space is 30 inches per prefresh cow. If standard 24” head locks are
used, the pen should be understocked (8 cows for every 10 head locks). In loose housed pens, maintain same bunk space and provide at least 120 square feet of resting space per cow. Transition cows have suppressed immune systems so dry, clean bedding and well-ventilated pens are extremely important for these cows.

2) Is adequate labor available to properly care for the cows? Adding groups increases the amount of labor needed to mix and deliver feed, to clean pens, to move cows, and to observe and monitor pens.

3) Can the cows be fed correctly? A major reason for having prefresh and fresh cows pens are to feed them specific diets. This will likely require more ingredients which will increase feed storage space needs and feed inventory. These pens usually have substantially fewer cows than lactation pens. Can the mixer properly mix a TMR for small groups?

If transition cows cannot be managed correctly because of facilities, labor, or equipment, the benefits that could be derived from tailored diets may not be realized. Indeed, moving cows from an uncrowded dry pen group to a wet, poorly ventilated crowded prefresh pen will likely increase problems regardless of how good the diet is. The nutritional recommendations discussed below assume that facilities and equipment are adequate.

**Late Gestation Nutrition**

**Energy.** The energy requirement for prefresh cows (~15 Mcal of NEL for average Holstein cow) is only slightly greater than that of far off dry cows and is still very low compared to an average lactating cow. However, because dry matter intake (DMI) is often more than 20% less by prefresh cows than far-off cows, in the past energy dense prefresh diets were recommended. Energy density could be increased by replacing fiber with starch or by adding supplemental fat. Fat is an expensive source of energy and no advantages have been observed from supplementing fat prepartum and it should not be supplemented to prefresh cows. Increasing starch and reducing fiber (NDF) concentrations was the most commonly recommended method of increasing energy density of prefresh diets. It was also thought that increasing the starch concentration of prefresh diets allowed the rumen to start adapting to the lactation diet. However based on the few studies that have been conducted, the prefresh diet does not affect rumen histology and rumen epithelium morphology. In general, responses by cow to increasing starch concentrations at the expense of fiber during the prefresh period have been mixed. Higher starch prefresh diets generally do not affect DMI postpartum (Holter et al., 1990; Olsson et al., 1998; Mashek and Beede, 2001; Agenas et al., 2003; McNamara et al., 2003; Dann et al., 2006; Kunz et al., 2010; Silva-del-Río et al., 2010; Mann et al., 2015). Milk production was usually not affected by feeding diets with increased starch but in some studies (Janovick and Drackley, 2010; Silva-del-Río et al., 2010; Richards, 2011), higher energy prefresh diets increased milk yield postpartum. Higher energy prefresh diets may increase the risk of subclinical and clinical ketosis (Doepel et al., 2004; Smith et al., 2008; Vickers et al., 2013).

A primary reason for increasing energy density of prefresh diets was to compensate for reduced DMI. However when far off dry cows are fed for ad libitum DMI but only enough energy to meet requirement the drop in DMI prepartum is only about 10% and is usually only during the last week. Therefore, when far off dry cows are fed correctly (adequate but not excessive energy), the majority of studies indicate little benefit from feeding a higher starch prefresh diet and some studies show negative effects. Energy and carbohydrates (starch and fiber) of prefresh diets should be similar to those of far-off dry cow diets.

**Protein.** Prefresh diets with about 12% CP will usually meet the NRC (2001) protein requirement. However, some have questioned whether additional protein prepartum will affect milk production after calving. A meta-analysis by Lean et al (2013) determined that feeding more than about 12% CP diets (ranged from 10 to 13%) prepartum did not increase milk yields or milk protein yields postpartum. Diets in the high CP treatments ranged from 12 to 23%. A criticism of that meta-analysis is that they evaluated CP but requirement systems are based on metabolizable protein. A recent meta-analysis reported in an abstract (Husnain and Santos, 2019) found that for cows (not heifers) feeding more than about 800 g of MP per day during the prepartum period did not affect milk or milk components yields postpartum. Assuming an efficiency of 0.65, 800 g of MP is approximately equal to a diet with 12% CP. For cows that
produced more than 80 lbs. of milk (presumably during the first month or so of lactation but not stated in the paper) increasing MP intake prepartum resulted in a statistically significant but very small increase in milk protein yield. For heifers, increasing MP in the prepartum period resulted in linear increases in DMI, and yields of milk and milk fat during the postpartum period. Increasing MP intake prepartum by heifers from 800 to 1100 g was associated with an increase of about 3.7 lbs. of DMI, 2.4 lbs./day of milk and about a 0.1 lbs./day of milk fat. Assuming an efficiency of 0.65, 1100 g of MP was approximately equal to a 15.5% CP diet.

Vitamins and Trace Minerals. No data are available on responses to special trace minerals supplementation during the prefresh period. Because many trace minerals are stored in the liver, short term increase in need for a mineral can be covered by release from the liver. Although data are lacking, extra supplementation of Cu, Mn, Zn and Se during the prefresh period is probably not necessary. The proper amounts of those minerals should be fed throughout lactation and the dry period to ensure adequate status. Demand for vitamins A and E increased markedly around parturition because of colostrum synthesis (both vitamins are in very high concentration in colostrum) and at least for vitamin E, because of increased utilization during parturition. The liver is very good at storing vitamin A when fed in excess and releasing it when inadequate amounts are consumed. An average cow secretes as much as 90,000 IU of vitamin A into colostrum so it is possible that increased intake of vitamin A during the prefresh period may be useful. Dry cows should be fed about 80,000 IU of vitamin A per day and this probably is adequate during the prefresh period. To cover colostrum and extra 5000 IU/day during the prefresh period would be required (i.e., 85,000 IU/day).

Data are clearer on the benefits of additional vitamin E during the prefresh period. Reduced mastitis, metritis, and retained placenta have been reported when prefresh cows are fed an extra 1000 to 4000 IU/day of vitamin E (i.e., 2000 to 5000 IU/d of supplemental vitamin E). Because of cost, the lowest supplementation rate (2000 IU/day during prefresh) is recommended.

Amino Acids Nutrition in Transition Cows

Compared to lactating cows, information about amino acids (AA) nutrition for transition cows is scarce. A major limitation to AA research prepartum is the uncertainty regarding response variables. Milk protein yield is the standard response measure when evaluating AA nutrition of lactating cows, but what responses should be measured when prepartum cows are fed diets with altered AA? Two common measures are milk component yields in early lactation and cow health during the transition period. Because of these measures, in most experiments, prepartum treatments continue after cows calve. Isolating the effect of feeding AA prepartum from effects from postpartum supplementation is usually not possible so most of this discussion will be on AA nutrition through the entire transition period.

Although most nutrient needs differ greatly between dry and lactating cows, treatments in experiments on AA nutrition of transition cows usually are based on what we know about lactating cows. Most studies with transition cows are based on the assumption that ideal AA diets should provide about 7.2 and 2.4% metabolizable Lys and Met (as a percent of MP). This is what NRC (2001) recommends for lactating cows. Most transition cow experiments include sources of rumen-protected (RP) Met and/or Lys as treatments.

Amino acids are the building blocks of proteins such as milk proteins, fetal proteins, and proteins within the mammary gland but AA have other metabolic functions as well. For example, most AA can be converted to glucose, Met can act as a methyl donor, and among other functions, AA are involved in regulating protein synthesis and gene expression.

Prepartum AA supply. During the last 3 weeks of gestation, fetal protein growth and maternal protein accretion (e.g., growth of mammary gland in preparation for lactation) equals about 250 to 300 g/day. In comparison, a cow producing 80 lbs./day of milk synthesizes about 1100 g of milk protein per day. Because of the relatively small amount of protein being synthesized by a prepartum cow, it is very unlikely that AA supplementation would affect fetal growth or maternal accretion of protein. We do not know much about how AA supply affects metabolic function, so changes in metabolic or physiological function cannot
be ruled out when AA nutrition is altered prepartum. One response to prepartum supplementation of RP-Met and/or RP-Lys that has been found in several recent studies (Zhou et al., 2016b; Batistel et al., 2017; Girma et al., 2019) is an average 2 lbs./day increase in dry matter intake (DMI) during the last 2 or 3 weeks of gestation. In a recent study we conducted using both RP-Lys and RP-Met, no effect on prepartum intake was observed which is consistent with several older studies. The variable responses suggest that AA supplementation interacts with other diet factors such as fiber concentrations, MP concentrations, AA composition, etc. At this time we do not know why RP-Met and/or RP-Lys increases DMI in some studies. Increased DMI prepartum may or may not be beneficial. If they prevent or reduce the decrease in DMI that occurs the last week of gestation, it would likely reduce concentrations of NEFA and ketones in blood and may reduce the incidence of ketosis. If the increase in DMI results in excess consumption of energy, then this could be a problem (discussed above).

A potential benefit of prepartum AA supplementation is that it may increase body reserves of labile protein. Based on most nutrition models, cows are in severe negative protein balance the first few weeks of lactation which means they must draw on labile body reserves. Increasing the size of the labile protein reservoir may help maintain milk production in early lactation and may help improve health and welfare of early lactation cows. Studies with sheep and dairy cows have shown that increasing MP supply in late gestation increases nitrogen retained in the conceptus (fetus, membranes, fluids, etc.) and in other maternal tissues including the mammary gland (McNeill et al., 1997; Putnam and Varga, 1998). In those experiments dietary CP ranged from about 8 to 16% (sheep trial) and 10 to 15% (dairy trial). The intermediate diet in both studies was about 12% and resulted in about the same N retention as the high protein treatments. Whether changing supply of specific AA would have similar effects is unknown.

In terms of health, insufficient evidence exists that changing prepartum supply of RPAA can improve health of cows after calving. Again, due to the experimental design of most transition cow trials, it is difficult to determine effects of prepartum supply of AA on health. From our recent study (Lee et al, submitted), prepartum supply of RPLys and RPMet decreased SCC of cows after calving regardless of postpartum supply of RPLys and RPMet; however, the level of SCC was generally low for most cows in this study (Figure 1). Prepartum and postpartum AA supplementation has also improved immune cells via enhanced phagocytosis and oxidative functions (Zhou et al., 2016a).

Figure 1. Effects of prepartum RPAA supplementation (3 weeks before calving) on SCC in milk (P = 0.01) postpartum (n = 44 cows/treatment). The bars represent mean ± SEM (Lee et al., submitted).
Postpartum AA supply. The purpose of balancing AA is to either increase milk protein yield or produce equal amount of milk protein while feeding lower protein diets (i.e., more efficient milk protein synthesis). Although the concept of limiting AA for lactating cows has been changing (from one or two limiting AA to multiple limiting AA), Lys and Met are generally accepted as the most two limiting AA in typical US lactation diets (i.e., corn silage and soybean meal based diets). Even though fresh cows are markedly different from cows in later lactation, most of the research on AA supplementation of fresh cows has been with RP-Lys and RP-Met. Most recent studies have shown positive responses when RP-Met was provided to fresh cows (RP-Met was actually provided continuously prepartum and postpartum), but the limited results with RP-Lys have not been promising (Table 1). Supplementation of RP-Met during transition often increases milk yield as well as milk protein yield. In these studies, the increase in milk yield could be a result of DMI because an increase in DMI was often observed in fresh cows when supplemental RPAA was provided. However the mechanism causing the increased intake is unclear. Increased DMI may have longer term positive effects on energy balance and reproduction. Met has numerous functions other than serving as a building block for protein synthesis and these other functions (e.g., methyl donor) may be one reason cows more often respond to RP-Met than RP-Lys. Another possible reason is that Met supply without supplementation is relatively more deficient than is Lys supply. In the studies with RP-Met it was fed at 10 to 15 g of digestible Met/day during the fresh period. In contrast to the other studies in Table 1, our study (Lee et al., 2019) found no effect of supplemental RP-Met on milk production in early lactation. The biggest apparent difference between our study and the others is that we fed only 16% CP during the fresh period whereas other studies fed 17 to 18% CP. The interaction between CP concentration and Met supplementation needs to be evaluated in a designed experiment but the data in Table 1 suggests that providing supplemental RP-AA during the fresh period does not allow feeding lower CP diets. Whereas in later lactation, AA supplementation often works quite well with low protein diets. In early- and mid-lactation cows, feeding RP-AA with reduced CP diets (10 to 20% below the MP requirement; NRC, 2001) often results in milk yield and milk protein yield equal to the higher protein control diets (Lee et al., 2012a; Lee et al., 2012b). Because DMI is so low in fresh cows, improving the AA profile of MP will likely not reduce the need to feed high CP diets to those cows.

Research using fresh cows is needed to evaluate the response to supplemental RP-His. Rumen protected His is not commercially available yet, but prototypes have been evaluated in later lactation cows. In lactating cows, adding RP-His to reduced CP diet (MP deficient based on NRC) can increase DMI, milk yield, and milk protein yield (Lee et al., 2012a; Giallongo et al., 2017). The positive response to RP-His has been consistent among studies. The reason we think cows respond to supplemental RP-His when fed low MP diets is that when dietary CP is reduced, the proportion of microbial protein that contributes to MP increases compared with the RUP contribution. However, because microbial protein is low in His this reduces the amount of His in the MP. We know very little regarding microbial protein synthesis and dietary protein breakdown (i.e., RDP) in the very fresh cows. These cows have low intakes and the rumen microbial population is in a state of flux because of the substantial change in diet that occurs after calving. We assume protein degradation and microbial protein synthesis is the same in fresh cows as in cows later in lactation (after adjusting for DMI) but we really do not know. Fresh cow diets are often high in CP (>17%) but because DMI is so low, His supply could still be limiting.

In terms of health, it is not possible to determine whether the observations resulted from prepartum, postpartum, or continuous prepartum and postpartum supplementation of RP-AA. In addition, most experiments were not designed to evaluate health responses (i.e., weak statistical power). However, given these experimental limitation, some potential health benefits from feeding RP-AA prepartum and postpartum were observed in cows after parturition. Prepartum and postpartum supplementation of RP-Met decreased the prevalence of ketosis and retained placenta (Zhou et al., 2016b). Supplementation of 10 g/d of digestible Lys from RP-Lys prepartum and postpartum lowered postpartum blood ketones (measured as BHBA) and NEFA (Girma et al., 2019). During the first 21 days of lactation, cows fed RP-Lys consumed about 5 lbs. more DM/day, but did not produce more milk which likely was the reason for reduced NEFA and ketones. Cows fed the RP-Lys had substantially lower BHBA than control cows; however average values were still in the subclinical ketosis range. In our recent study (Lee et al., submitted) postpartum RP-AA (Met and Lys) reduced postpartum blood BHBA from 890 to 660 mM whereas prepartum supplementation of RP-AA had no effect on pre or postpartum BHBA.
In summary, there is not sufficient data to conclude that prepartum RP-AA supplementation improves production of cows after parturition. However, increased DMI with RP-AA was often observed in prepartum cows and could be improve energy status postpartum. For fresh cows, improving AA profile of MP should improve production and dietary N use efficiency. However, the quantity of energy and protein is the first factor to consider when a ration is formulated. Then, RP-AA can be added to improve AA profile of MP, which may increase milk yield and milk protein yield of fresh cows. Furthermore, there are likely multiple limiting AA, not just one or two AA, in lactating cows, and this is likely true for fresh cows as well. Some data suggests that RP-Lys and RP-Met may reduce ketosis and some other periparturient health problems. It is not known whether supplementation during both prefresh and fresh period is needed to see these effects.

| Table 1. Effects of supplementation of RPAA on performance in fresh cows<sup>1,2</sup> |
|---------------------------------|------|----|-------------|-----|---|---|---|---|
|                               | Prepartum CP | Postpartum CP | AA | Supplementation<sup>3</sup> | DMI | Milk | Protein | Fat | ECM |
| Girma et al. (2019)            | 15.1 | 18.0 | RPLys | Pre- (10 g/d dLys) and postpartum (10 g/d dLys) | UP | 0 | 0 | 0 | 0 |
| Batistel et al. (2017)         | 15.7 | 17.7 | RPMet | Pre- (8 g/d dMet) and postpartum (15 g/d dMet) | UP | UP | UP | UP | UP |
| Zhou et al. (2016)             | 14.6 | 17.2 | RPMet | Pre- (10 g/d dMet) and postpartum (18 g/d dMet) | UP | UP | UP | UP | UP |
| Osorio et al. (2013)           | 15.0 | 17.5 | RPMet | Pre- (7 g/d dMet) and postpartum (10 g/d dMet) | UP | UP | UP | UP | UP |
| Lee et al. (2019)              | 12.2 | 16.1 | RPLys and RPMet | Postpartum or pre- (8 g/d dLys and 4 g/d dMet) and postpartum (23 g/d dLys and 10 g/d dMet) | 0 | 0 | 0 | 0 | 0 |

<sup>1</sup>Responses to RP-AA were based on control in each experiment, i.e., no RPAA supplementation.  
<sup>2</sup>UP = RP-AA increased the measure compared with control; 0 =, no response to RP-AA was observed.  
<sup>3</sup>Most studies provided RP-AA to cows continuously prepartum and postpartum (dAA = digestible AA).

**Fresh Cow Nutrition**

**Protein.** If nutrition models are correct for the very fresh cow (<21 days in milk), a typical fresh cow would need to be fed a diet with more than about 13% MP (which is approximately equal to 20% CP), to avoid being in negative protein balance during the first few weeks of lactation. Although the exact amount of MP needed is not known, fresh cows respond to increased MP. During the first 21 days of lactation, fresh cows fed a 19% CP diet produced about 5 lbs./day more milk than cows fed 16% CP (Komaragiri and Erdman, 1997). The concentration of milk fat was similar between treatments but milk protein percent was higher for the high protein group. In that study, protein was increased by a blend of fish meal and blood meal which should have increased supply of Met, Lys, and His. Amanlou et al. (2017) fed diets with 16, 19, and 21% CP (approximately 10.3, 11.8, and 13.6% MP) to cows the first 21 day after calving (Table 2). Based on the NRC (2001) model, all diets were deficient in MP but the 21% CP diet was only 130 g/day deficient whereas the 16% CP protein diet was 440 g/day deficient. Lysine was about 15% deficient in all diets but Met was close to adequate in all diets (based on NRC model). Major supplemental protein sources in the diets were cottonseed meal, canola meal, soybean meal, fish meal
and corn gluten meal. Cows fed the diets with 19 and 21% CP produced almost 12 lbs. more milk, and about 0.25 and 0.5 lbs. more milk fat and milk protein than cows fed the 16% CP diet. Increasing dietary protein from 19 to 21% did not statistically increase milk and milk components yields but the authors did not use the correct statistical test and it is very likely that protein continued to increase even up to 21% CP. Dry matter intake also increased so that calculated energy balance did not differ between treatments.

Increasing dietary MP from about 9.5% to 11.7% (approximately equal to increasing dietary CP from 16 to 18.8%) by infusing a blend of AA that mimicked casein were infused into the abomasum of fresh cows (from 1 to 29 days in milk) increased milk yield almost 17 lbs./day for the first 29 day of lactation and milk protein yield increased about 190 g/d (about 0.4 lbs./day) (Larsen et al., 2014). Dry matter intake (including what was infused) did not different between treatments, but fat yield was increased about 270 g (0.6 lbs./day). The increase in fat yield may not have been a good thing because most of the additional fat was from mobilized body fat and infused cows had greater loss of body condition and elevated blood NEFA and ketones. Greater loss of body condition may have negative effects later in lactation with respect to peak production and reproduction. Although this study does not show that cows will response to one or two AA it clearly shows that providing a good balance of AA in early lactation has a very large effect on milk yield during the first ~3 weeks of lactation.

**Table 2. Effect of feeding increased protein during the fresh period (1 through 21 days in milk) on milk production (data from Amanlou et al., 2017)**

<table>
<thead>
<tr>
<th>Diet composition, % of DM</th>
<th>16% CP</th>
<th>19% CP</th>
<th>21% CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP, %</td>
<td>16.0</td>
<td>18.7</td>
<td>21.4</td>
</tr>
<tr>
<td>RDP, %</td>
<td>11.0</td>
<td>11.7</td>
<td>12.4</td>
</tr>
<tr>
<td>RUP, %</td>
<td>5.0</td>
<td>7.0</td>
<td>9.0</td>
</tr>
<tr>
<td>NDF, %</td>
<td>32.0</td>
<td>31.0</td>
<td>30.0</td>
</tr>
<tr>
<td>NFC, %</td>
<td>41.0</td>
<td>39.0</td>
<td>37.0</td>
</tr>
<tr>
<td>DM intake, lbs./day</td>
<td>34.3</td>
<td>37.4</td>
<td>37.2</td>
</tr>
<tr>
<td>Milk yield, lbs./day</td>
<td>71.9</td>
<td>82.3</td>
<td>86.2</td>
</tr>
<tr>
<td>Fat-corrected milk, lbs./day</td>
<td>69.1</td>
<td>76.8</td>
<td>86.2</td>
</tr>
<tr>
<td>Milk fat, lbs./day</td>
<td>2.7</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Milk protein, lbs./day</td>
<td>2.2</td>
<td>2.6</td>
<td>2.8</td>
</tr>
</tbody>
</table>

\textsuperscript{a,b} Means significantly different.

Our lab conducted an experiment a few years ago (Carder and Weiss, 2017) to determine whether greater concentrations of digestible Lys and Met would yield the same production responses as would greater concentrations of MP that provided lesser amounts of digestible Met and Lys. The control diet contained 16.3% CP (estimated MP = 9.5%). The main supplemental sources of CP were soybean meal, treated soybean meal and whole cottonseed. The high protein diet contained more treated soybean meal and some corn gluten meal and had 18.4% CP (estimated 11.5% MP). The AA treatment contained 17.4% CP but because of changes in degradable and undegradable protein it also had 11.5% MP. The diet contained a commercial protein supplement based on blood meal with additional RP-Lys and RP-Met (LysAAAMet from Perdue Agribusiness). During the first 21 days of lactation, feeding more MP with or without additional AA increased milk fat yield by about 0.5 lbs./day but surprisingly it did not increase milk protein production. Increasing the supply of digestible Met and Lys increased milk protein percentage. An important finding from this study was that the effects of feeding different protein treatments during the first 21 days of lactation lasted several weeks after cows were switched to a common diet. From 21 days in milk through 84 days, cows that were fed higher protein diets the first 21 days of lactation continued to produce milk with greater milk fat percentage and cows that were fed higher MP with AA continued to produce milk with a higher concentration of milk protein. This study shows that fresh cow nutrition has long lasting effects and when considering feed costs, potential carryover effects should be considered. In other words, a high priced diet that is fed for 21 days may be worth it because of carryover effects.
These data in total support the concept that a fresh group (up to about 21 days in milk) should be fed high protein diets. Diets must be adequate in rumen degradable protein (>10%) and rumen undegradable protein should be >8% and it should be from high quality source that provide a blend of AA. Data on the value of specific AA supplementation is less positive than simply feeding more MP.

**Supplemental Fat.** Fresh cows are often in negative energy balance which would suggest that they are prime candidates to be fed supplemental fat. However, because of potential negative effects on DMI, fat supplementation of fresh cows is often discouraged. Negative effects of fat supplementation are more likely to occur with unsaturated fats and newer products are available that allow for supplementation of specific fatty acids. Supplementing fresh cow diets with 1.9% saturated fatty acids (Energy Booster 100®) increased DM intake by about 3 lbs./day for the first 29 days of lactation, but this did not result in increased yields of milk or milk components (Piantoni et al., 2015). In fact, energy corrected milk yield was about 4 lbs. lower when fat was supplemented. The negative effect appeared (not statistically significant) to occur when fed with lower forage diets (20% forage NDF) but not in higher forage diets (26% forage NDF). Cows fed supplemental fat lost about 50 lbs. less BW during the first 29 days in milk indicating that the energy from the fat was partitioned toward body reserves rather than milk.

Another study with fresh cows (first 24 days of lactation) evaluated a fat supplement that contains predominantly palmitic acid (Palmit 80®) at an inclusion rate of 1.5% of DM. The fat supplement had no effect on DM intake (averaged 49 lbs./day) or milk yield (105 lbs./day) but it increased fat yield by 0.6 lbs./day and protein yield by 0.2 lbs./day. The greater fat yield with equal intakes caused greater mobilization of body fat resulting in greater loss of body weight and body condition by cows fed supplemental fat. After 24 days, cows in each of those treatment groups were divided into 2 new groups and either fed 0 or 1.5% added Palmit 80 from 25 until 67 days in milk. This resulted in 4 treatments: no fat during fresh or peak production periods; fat fed during both fresh and peak production; fat fed during fresh but not peak production period; and no fat during fresh period but fed during peak production period. Intake during peak production period (25 to 67 days in milk) did not differ across treatments. Feeding the fat supplement the entire period (1 through 67 days in milk) resulted in the greatest milk fat and energy corrected milk yields; however it also resulted in the greatest loss in body weight and condition. During the first 67 days of lactation cows fed supplemental fat the whole time produced 350 lbs. of milk fat but cows fed supplemental fat just between 25 and 67 days produced 341 lbs. of fat during the first 67 days. That additional 9 lbs. of milk fat resulted in almost 50 lbs. of increased body weight loss. Delaying fat supplementation until after the 3 or 4 week fresh period is probably better when all things are considered.

**Conclusions**

Preventing hypocalcemia and a large decrease in DM intake prepartum should be the primary goal of prefresh nutrition. Diets with about 12% CP are probably adequate for prefresh cows and it is unknown whether AA supplementation during the prefresh period (without postpartum supplementation) has any benefit. Postpartum, fresh cows respond to very high CP (~18 to 20%) diets by increasing yields of milk, milk protein and milk fat. Supplementation of RP-Met increases DM intake and milk and milk component yields. Supplementation of certain saturated fats shows some positive responses but when changes in body condition are considered, delaying supplementation until week 4 of lactation is probably best.

**References**


