Seasonal Effects on Milk Components

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Summer has arrived! The days are getting longer and the temperature is rising. However, you may now begin to notice the not so pleasant part of summer: a decline in milk components. The graph below highlights a very repeatable seasonal pattern of observations in milk fat and protein concentrations as seen over a ten-year period of time in the Mid-East Milk Order. Milk fat and protein concentrations peak in the winter months and fall to their lowest point around July and August, with the annual range for milk fat being approximately 0.25 percentage units.

This highly repeatable pattern appears to be independent of year-to-year differences in forage quality and weather. A similar pattern is also observed for other milk marketing orders in different regions of the U.S. that experience even more heat stress. Is this an effect of hotter temperatures, longer days, or maybe both?

Impact of Heat Stress on Milk Yield and Milk Fat
Heat stress decreases dry matter intake (DMI) in cattle, and a decrease in milk production follows. However, the decrease in DMI observed during periods of heat stress only accounts for about 35% of the observed decrease in milk yield. Other metabolic factors influence milk production during periods of heat stress. Heat stressed animals may have lower levels of blood protein and energy due to the in-efficiencies of rumination and metabolism during this heat challenge. Both blood protein and energy levels can influence milk and milk fat yields. In addition to eating less and drinking more, feeding patterns change during heat stress. Cows tend to slug feed during cooler periods of the day so as not to increase heat of digestion. Slug feeding can result in periods of ruminal acidosis, which can decrease milk fat content. Additionally, highly fermentable diets (more starch and sugar) are commonly fed to dairy cows to maximize energy intake and increase the ease of substrate breakdown in the rumen. Highly fermentable feeds result in a rapid production of energy favoring volatile fatty acids after consumption which reduces ruminal pH and can depress fiber digestion and ultimately cause milk fat depression (Harvatine, 2012).

Figure 1. Season pattern of milk fat and milk protein percent over a 10-year span in the Mid-East Milk Market.

Courtesy: Dr. Kevin Harvatine

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Heat Stress and Milk Protein

Why does milk protein decrease so substantially in the summer? Recently, a trial was conducted in Australia to determine the impact of heat stress on milk protein content (Cowley et al., 2014). Dry matter intake of cows in a heat stressed environment was monitored, and a control group of cows in a thermal neutral climate were fed the same ration at the same level of intake. The heat stressed animals had lower milk protein content than did the animals with similar DMI in a thermal neutral climate. What could be happening? Amino acids (AA) are the building blocks of protein, and in normal conditions, the cow prefers to use AA for protein production. During periods of heat stress, the cow may be using more amino acids for energy production to meet additional requirements. Therefore, fewer AA may be available for milk protein production.

Impact of Photoperiod on Milk Composition

Increased long days (16-18 hours of light and 6-8 hours of darkness) for lactating cows will generally result in about 5 lbs more milk. However, milk composition is unaffected by these increased number of long days. Short day periods (< 8 hours/day of light) are recommended for dry cows. Decreased day length during the dry period results in increased milk yields and milk components after calving. An analysis of Israeli dairy herds determined that cows with a dry period during shorter days (winter) had 0.27 units more milk fat and 0.08 units more milk protein in the following lactation (Aharoni et al., 2000).

Nutritional strategies to improve milk components in the summer:

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Benefit</th>
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</thead>
<tbody>
<tr>
<td>Increase sodium bicarbonate (8 ounces)</td>
<td>Improves rumen buffering capacity</td>
</tr>
<tr>
<td>Feed more digestible forages to high producing cows</td>
<td>Reduces heat of digestion</td>
</tr>
<tr>
<td>Increase fat content of ration with rumen inert fat</td>
<td>Improves energy supply</td>
</tr>
<tr>
<td>Feed higher metabolizable protein diets</td>
<td>Matches increased AA supply with demand</td>
</tr>
<tr>
<td>Balance ration for lysine and methionine</td>
<td>Improves efficiency of use of total dietary protein</td>
</tr>
<tr>
<td>Don't feed excess RDP</td>
<td>Energy is wasted to metabolize excess RDP</td>
</tr>
</tbody>
</table>

Take home messages:

- Milk fat and protein contents across dairy herds decrease during spring and summer months.
- Efficient use of dietary protein and amino acids is key in maintaining milk protein content as much as possible in the summer.
- Evaporative cooling is the best method for combating heat stress.
- Seasonal variation in milk components may not be explained simply by long and short days, but changes in day length are one of the most repeatable changes that occur through the year and requires further investigation.

Safety message: Be aware of signs of dehydration in yourself and employees on the dairy. Look for these signs of dehydration in adults as described by webmd.com: increased thirst, dry mouth, swollen tongue, weakness, dizziness, palpitations, confusion, sluggishness, fainting, inability to sweat, and decreased urine output.

References:

