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DIET COMPOSITION, MILK FAT and FAT SUPPLEMENTATION

By Sylvia Borucki, PhD

Fat is typically the most variable component in milk, and is affected by breed, lactation status, and management of the environment and feeding. Within 1 to 2 weeks, milk fat depression can be alleviated by changing the diet whereas protein in the milk may take 3 to 6 weeks or longer. Nutrition and ration formulation changes are more strongly correlated to milk fat content than milk protein. Milk fat can vary from 0.1 to 1.0 percentage points, whereas protein is seldom altered more than 0.1 to 0.4 points by nutritional changes.

MILK FAT PRODUCTION

(A) Digestion of fiber in the rumen produces the volatile fatty acids (VFA) acetate and butyrate. Butyrate provides energy for the rumen wall, and much of it is converted to beta-hydroxy-butyrate. About half of the fat in milk is synthesized in the udder from acetate and beta-hydroxy-butyrate.

(B) The other half of milk fat is transported from the pool of fatty acids circulating in the blood. These can originate from body fat mobilization, absorption from the diet, or from fats metabolized in the liver.

Rumen Ecology. Consistently providing adequate sources of energy and protein, balanced amounts of rapidly fermentable carbohydrates and effective fiber for optimal rumen ecology with adequate microbial population are the key to increasing the milk components production. The challenge in feeding for milk components is that high energy, low fiber diets that increase milk protein tend to reduce milk fat levels.

Concentrates. An increase in the intake of concentrates causes a decrease in fiber digestion and decrease in acetate production, but increases of propionate production. Propionate production encourages milk production, energy balance and fat deposition (improve body condition) but does not directly promote milk fat. Intakes of substantial amount of concentrates or a low forage: concentrate ratio disrupt rumen ecology and promotes acidosis. The addition of buffers in the ration's premix may help to prevent acidosis; this will not change milk protein, but will avoid milk fat depression. The non-fiber carbohydrate (NFC) portion of the diet is highly digestible and can influence both fat and protein in milk. Generally an NFC of 32 to 38% of ration dry matter is recommended to optimize production of milk fat and protein.

Forage Level and Particle Size. Rations for lactating cows should contain at least 45% of ration dry matter from forage. This may be altered by the level of corn silage/haylage in the ration and the level of high-fiber by-product feeds. Potential reasons for low forage intake are inadequate forage: concentrate ratio, low fibre forage (cut too young) or a change in the particle size of the forage. Target a diet with forage fiber NDF of 0.9% of bodyweight daily.

Feeding Strategy. Protein and fat content can also be changed due to the physical form of the forage being fed. Much of this is related to ration sorting and failure to provide a consistent diet throughout the day. Coarsely chopped silage and dry hay (very long fiber length) are the most common causes of sorting. At the other extreme, very finely ground diets, increase passage rate, decrease fiber digestion and depress fat and protein production. Monitor the ration's particle size to ensure that adequate effective fiber (fiber length) is provided and ensure that the TMR is mixed properly, evenly distributed and that sorting is minimal.

Fatty Acid (FA) Supplementation. Adding fat to the ration can affect milk fat levels depending on the amount and source of fat. Excessive unsaturated fats/ oils are generally toxic to rumen microbes and may reduce fiber digestibility if fat exceeds 5% of ration dry matter. Milk fat depression is due to bio-hydrogenation of unsaturated FA and the passage of specific