Dairy Australia

MILK FAT DEPRESSION

For many years marked depression in milk fat concentration in dairy herds has been presumed to be due to a reduction in rumen microbial production of acetate and butyrate (which are precursors for milk fat synthesis in the udder) versus propionate, due to changes in rumen fermentation associated with high grain/concentrate intake and reduced fibre intake.

However, it is now understood that incomplete bio-hydrogenation of excessive dietary polyunsaturated fatty acids (PUFAs) (principally linoleic acid) by the ruminal microbes may play a major role in milk fat depression.

For milk fat depression to occur through incomplete bio-hydrogenation, two conditions are required:

- the presence of significant levels of PUFAs in the rumen – e.g. from high quality pasture (which can be quite high in oil content)
- an alteration in ruminal fermentation processes – as may occur with high grain/low roughage diets

Alterations in rumen fermentation involve both the microbial fermentation of dietary carbohydrates and the microbial bio-hydrogenation of fatty acids. High grain/low roughage diets are associated with low rumen pH, changes to the microbial population and high outflow rates of rumen fluid and digesta, even to the extent of sub-acute rumen acidosis occurring. When diets that are low in fibre are supplemented with plant oils, thereby providing plenty of PUFAs, there is ample opportunity for some of the lipid to escape full bio-hydrogenation because of the fast rate of outflow from the rumen.

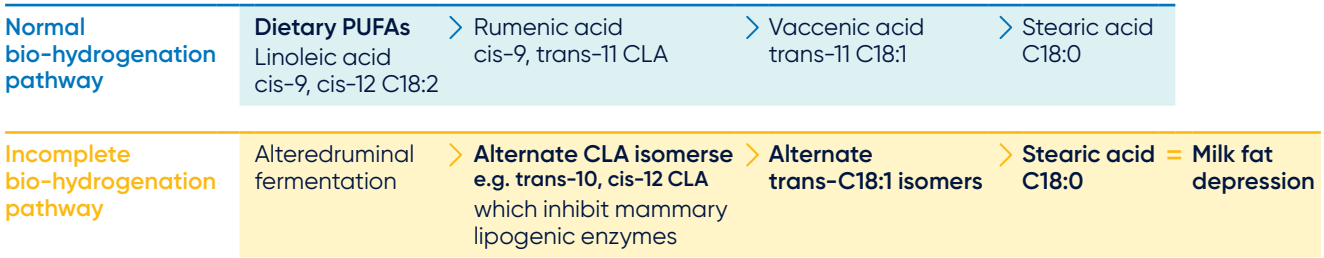
Only a very small amount of trans-10, cis-12 Conjugated Linoleic Acid (CLA) produced from altered rumen fermentation is needed to cause a 25% reduction in milk fat concentration. Conversely, if the oils are completely hydrogenated or they bypass the rumen microbes because they are fed in a rumen-protected form, there are minimal effects on milk fat concentration.

All of this means that low fibre per se may not be the only, or even the major, factor causing low milk fat concentrations. However, although milk fat depression may have little to do with fibre insufficiency, the lack of fibre does result in rumen conditions depression that affect the bio-hydrogenation of dietary fatty acids, which could be the real culprit.

Importantly, however, there must be reasonable quantities of polyunsaturated fatty acids in the diet in the first instance for partial bio-hydrogenation to result in the unique fatty acid intermediates that inhibit milk fat synthesis in the udder.

We are yet to fully understand the factors contributing to milk fat depression in pasture-based feeding systems and how to manage it.

Figure 26 Biohydrogenation pathways during normal and altered ruminal fermentation



Source: Adapted from Harvatine KJ, Bauman DE (2007) Recent advances in milk fat depression: 1. Time course of milk fat depression and 2. Adipose tissue lipogenesis during milk fat depression: Cornell University.

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